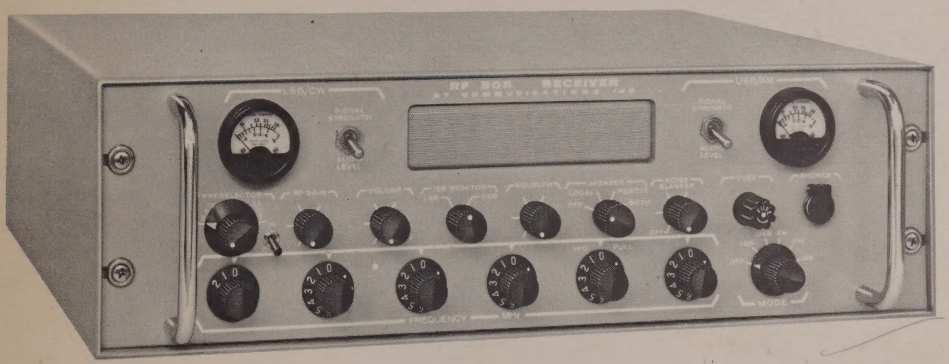
SERIAL NO. 118 INSTRUCTION MANUAL/PM-0711



rf

# RF-505

## RECEIVER

RF COMMUNICATIONS, INC. ROCHESTER, NEW YORK, U.S.A.

# WARRANTY

R F Communications, Inc. warrants the equipment purchased hereunder to be free from defect in material and workmanship under normal use and service, when used for the purpose for which the same is designed, for a period of one year from the date of delivery, provided that notice of such defect is given to R F Communications within sixty (60) days after the discovery thereof and provided that inspection by R F Communications indicates the parts are defective to R F Communications' reasonable satisfaction. R F Communications' obligations under this warranty are limited to the repair or replacement of defective parts and the return of such repaired or replaced parts to the purchaser F.O.B factory. At R F Communications' option, any defective part shall be returned to R F Communications' factory for inspection, properly packed and all expenses prepaid. No parts shall be returned unless the purchaser first obtains a return authorization number, which will be furnished on request. Electron tubes are warranted in accordance with the manufacturer's standard tube warranty policy, which will be furnished on request. Equipment furnished by R F Communications, but manufactured by another, bears only the warranty given by such other manufacturer, which will be furnished on request. No warranties other than those set forth in this section are given or are to be implied with respect to the equipment furnished hereunder and R F Communications shall in no event be liable for consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

# CORRESPONDENCE AND PARTS ORDERING

Whenever writing about this unit or ordering parts, always refer to the model and serial numbers and the approximate date of purchase. Special parts should be ordered by the R F part number and the schematic designation number. Standard parts can be obtained from your local parts distributor.

## NOTE

The serial number of each RF-505 Receiver is stamped in the back panel to the right of TB1 opposite terminal 1.

# RETURN OF EQUIPMENT

No part shall be returned to RF Communications Field Service Department unless the purchaser first obtains a return merchandise authorization number (RM). This number is to be marked on the shipping container.

# ACCESSORIES

From time to time, new accessories are added to our product line. Often, these are a result of particular customer needs. Our sales department will be happy to discuss your requirements and suggest possible solutions.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0946
APPLICABLE SDN No.(S) MPES-53
APPLICABLE DCN No.(S) MPE-263

APPLICABLE TO: RF-505
(724-0800 Assy.)
(Second L.O. Gen.)

To improve the 3.5 MHz output level the value of capacitors C10 and C53 have been changed from 0.01 UF to 0.1 UF. To facilitate this change a 0.1 UF capacitor was added in parallel ( on the foil side ) with the existing capacitors on all assembled boards. Make the following changes in your instruction manual, either PM-0711 or PM-0711A.

Page 8-35, Circuit Diagram, 724-0800.....Change C10 and C53 to 0.1 UF

Page 8-36, Parts List, 724-0800.....Change C10 and C53 to Capacitor, Ceramic Monolythic, 0.1 UF +80%-20%;25Vdcw RF P/N C-5066.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0934
*APPLICABLE SDN No.(S)* MPES-51
*APPLICABLE DCN No.(S)*

*APPLICABLE TO:* RF-505
(Speaker Driver Assembly and Receiver Mother Board)

Changes have been made on the RF-505 Receiver to eliminate oscillation. Make the following changes in your Instruction Manual PM-0711 or PM-0711A.

Page 7-19, Receiver Module Circuit Diagram, Figure 7.2.....
Show two added 0.01 uF capacitors, C6 connected between ground and pins 9 and K of P1201 and C7 connected between pins 9 and K of P1202 and ground.

Page 7-20, Receiver Module Parts List.....Add:

C6 Capacitor,Ceramic,Disk: 0.01uF+60%-40%;150 Vdcw RF P/N C-0065
C7 Capacitor,Ceramic,Disk: 0.01uF+60%-40%;150 Vdcw RF P/N C-0065

Page 7-27, Speaker Driver and Squelch Gate Assembly, fig.7.6...

Change R11 to 120 ohms.

Page 7-28, Speaker Driver and Squelch Gate Assembly,Parts List

Change R11 to 120 ohms RF P/N R-0013

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0933
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)* MPE-258

*APPLICABLE TO:* RF-505
(724-1250 Assembly)

Changes have been nade in the 724-1250 Speaker Driver and Squelch Gate assembly to increase audio output. Make the following changes in your Instruction Manual PM-0711 and PM-0711A.

Pg. 7-28, Parts List 724-1250.....Change to read as follows:

| | | |
|---|---|---|
| C3 | Capacitor, tantalytic; 10uF; 30Vdcw | RF P/N C-6327 |
| C4 | Capacitor, tantalytic; 150uF; 30Vdcw | RF P/N C-2851 |
| R2 | Resistor, Carbon; 12K±10%; 1/4W | RF P/N R-0037 |
| R10 | Resistor, Carbon; 1.8K±10%; 1/4W | RF P/N R-0027 |
| R11 | Resistor, Carbon 56 ohms±10%; 1/4W | RF P/N R-0009 |

Pg. 7-27, Circuit Diagram 724-1250.....

Change: C3 to 10uF
C4 to 150uF
R2 to 12K
R10 to 1.8K
R11 to 56 ohms

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0932
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)*

*APPLICABLE TO:* RF-505
(Main Frame)

The connection between the IF Gain Control (724-0260) and the Preselector Assembly (724-1650) was omitted. Correct your instruction manual (PM-0711A) as outlined below to show the proper connection.

Page 6-9, Circuit Diagram Figure 6.1 .....

Add "IF GAIN CONTROL OUTPUT" terminal to Preselector Assembly and terminal "E4" to IF Gain Control Assembly. Show added connection between added E4 and IF Gain Control Output terminal.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0929 *APPLICABLE TO:* RF-505

*APPLICABLE SDN No.(S)*

*APPLICABLE DCN No.(S)* MPES-48

The value of capacitor C26 has been changed in the HF Divider Assembly. Please make the following changes in your Instruction Manual PM-0711 or PM-0711A:

Pg. 8-28, Parts List, HF Divider Assembly 724-0600..... Change the value of C26 to read 1100 pF RF P/N C-0153.

Pg. 8-27, Circuit diagram.....Change the value of C26 to 1100 pF.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0928 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)* MPE-252

Please make the following changes in your Instruction Manual PM-0711 and PM-0711A.

Pg. 7-26, Parts List, Detector/AGC Assy. 724-1200.....

Change R22 and R24 to read as follows: Resistor,Carbon; 100K± 5%; 1/4 W RF P/N R-1297.
Change R51 to read: Resistor, Carbon; 220 ohms ±10%; 1/4 W RF P/N R-0016.

Pg. 7-25, Detector/AGC Assy., Circuit diagram.....Change the value of R22 and R24 to 100K. Change the value of R51 to 220 ohms.

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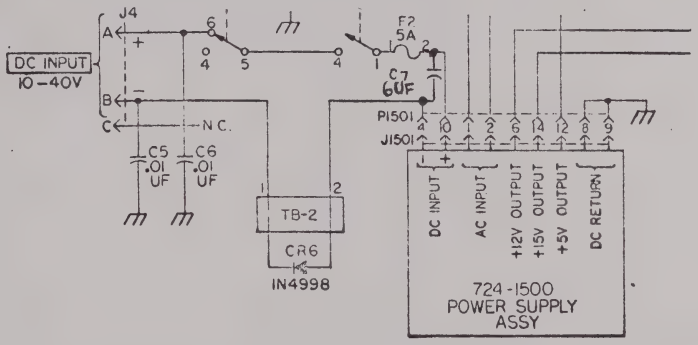
# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0926
APPLICABLE TO: RF-505
APPLICABLE SDN No.(S)
APPLICABLE DCN No.(S) MPE-251

Please make the following changes in your Instruction Manual PM-0711 and PM-0711A.

Pg. 6-10, Parts List, Main Frame.....Add C7, Capacitor, Poly Film; 6uF, RF P/N C-1196.

Pg. 6-9, Main Frame Circuit Diagram.....Add C7, 6uF across pins 4 and 10 of Power Supply connector J1501.




Pg. 9-12, Parts List, Power Supply Module.....Delete C1, Capacitor, Electrolyte, 1.0uF±20%; 100 Vdcw RF P/N C-5880.

Pg. 9-10,Power Supply Module, Circuit Diagram.....Delete C1, 1.0 uF.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0919A APPLICABLE TO RF-505
APPLICABLE SDN No.(S)
APPLICABLE DCN No.(S) MPE-253

Please make the following changes in your Instruction Manual PM-0711A

Pg. 9-12, Parts List, Power Supply 724-1500.....Delete C36, Capacitor,Ceramic; 0.1uF+80%-30%;75Vdcw RF P/N C-0063.

Pg. 9-11, Circuit Diagram.....Delete C36

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0919
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)* LPES-246

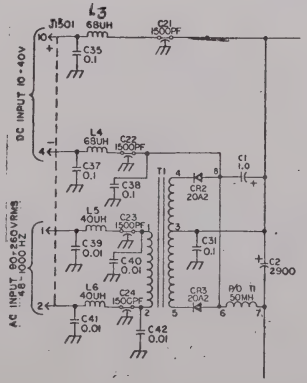
*APPLICABLE TO:* RF-505
Power Supply Module
724-1500

The circuitry of the Wide Range Power Supply Module, 724-1500, has been modified to reduce power line radiation. Make the following changes in your Instruction Manual PM-0711:

Page 9-12, Parts List.....Add to Power Supply Module-724-1500:

| | | |
|---|---|---|
| C35 | Capacitor,Ceramic;0.1uF+80%-30%;75Vdcw; | RF P/N C-0063 |
| C37 | Capacitor,Ceramic;0.1uF+80%-30%;75Vdcw; | RF P/N C-0063 |
| C38 | Capacitor,Ceramic;0.1uF+80%-30%;75Vdcw; | RF P/N C-0063 |
| C39 | Capacitor,Ceramic;0.01uF GMV;1K; | RF P/N C-0008 |
| C40 | Capacitor,Ceramic;0.01uF GMV;1K; | RF P/N C-0008 |
| C41 | Capacitor,Ceramic;0.01uF GMV;1K; | RF P/N C-0008 |
| C42 | Capacitor,Ceramic;0.01uF GMV;1K; | RF P/N C-0008 |
| L3 | Choke,68UH; | RF P/N L-0109 |
| L4 | Choke,68UH; | RF P/N L-0109 |
| L5 | Choke,40UH; | RF P/N L-0108 |
| L6 | Choke,40UH; | RF P/N L-0108 |

Page 9-11,Circuit Diagram.....Change the input circuitry of Transformer T1 to show the addition of C35 through C42 and L3 through L6 as shown below:



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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0910 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPE 238
*APPLICABLE DCN No.(S)*

The following product improvement changes have been made on on the RF-505 Receiver. These changes were incorporated to provide the operator with manual if. gain control using the RF GAIN front panel control. Make the following changes to Instruction manual PM-0711

Page ii, List of Illustrations.....Change figure 6.3 to..... If. Gain Control Assembly Circuit Diagram.

Page 3-2, Table3.1.....Change function of RF GAIN control to read....."Adjust attenuation of received signal levels and controls agc voltage in Receiver Module. Counterclockwise rotation decreases input signal level and reduces if. gain."

Page 3-3, Paragraph 3.3.1.....Add the following note after step e:

NOTE

The RF GAIN control is normally left fully clockwise for maximum sensitivity, but can be adjusted counterclockwise for extremely strong signals or to reduce background noise. By adjusting RF GAIN control so that the S-meter fluctuates only about 1/2 S-units during a period of reception, background noise normally heard between speach syllables is reduced considerably.

Page 3-4, Paragraph 3.3.1.....After step h add the following note.

NOTE

Readjust SQUELCH control setting as outlined in step h each time the RF GAIN control is adjusted.

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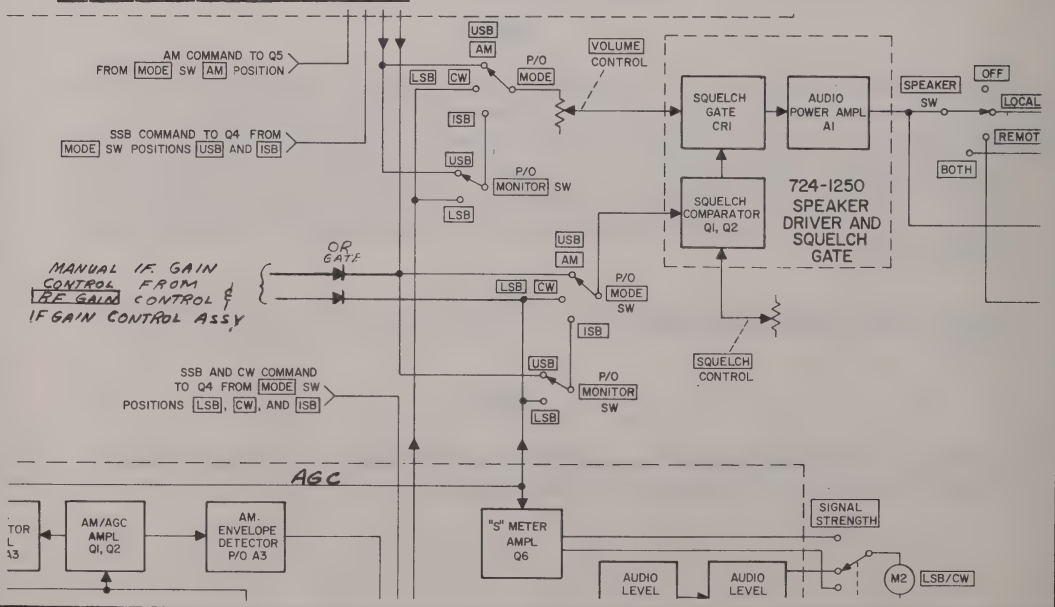
# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0910 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPE 238
*APPLICABLE DCN No.(S)*

Page 4-1, Paragraph 4.3.....Add after last sentence of first paragraph "In addition, the RF GAIN control provides, for the operator, manual control of the receiver if. gain."

Page 4-3/4-4.....At end of text add the following: The front panel RF GAIN control operates in conjunction with the agc voltage to control the if. gain of each receiver channel. This is accomplished by placing agc voltage, controlled by the position of the RF GAIN control, through two OR gates on each agc line in the receiver module. The operator can then reduce the if. gain when receiving very strong signals. The use of diode OR gates permits the automatic gain control to function as normal for any large fluctuating signal above the adjusted level.

Page 4-5, Block Diagram.....Change figure 4-2 as shown below:



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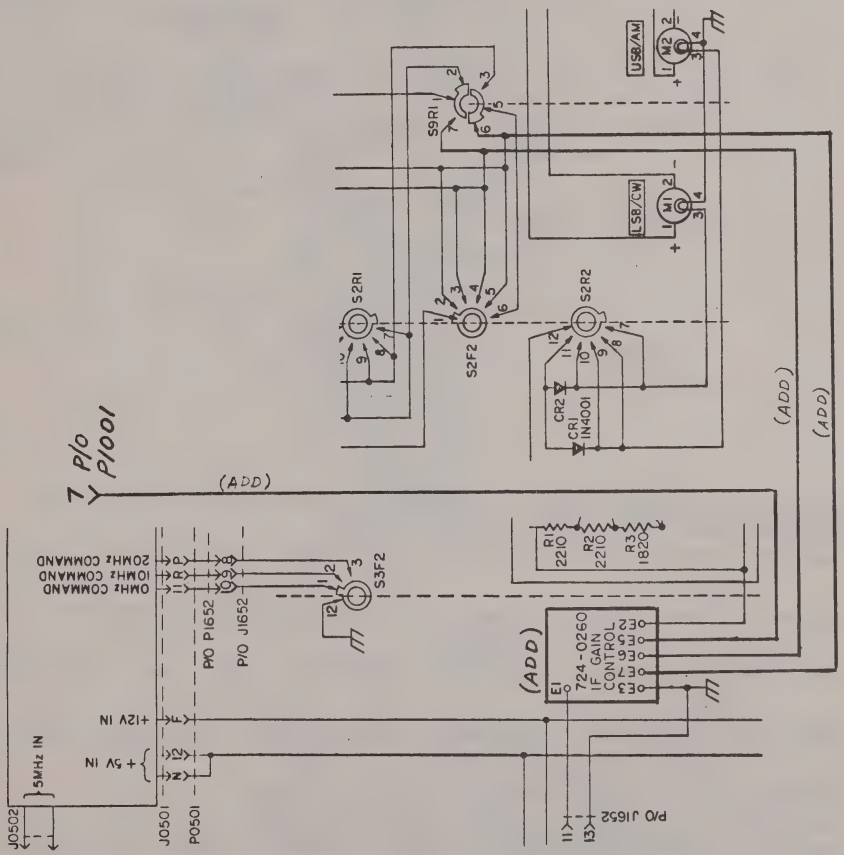
# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-9010 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPE 238
*APPLICABLE DCN No.(S)*

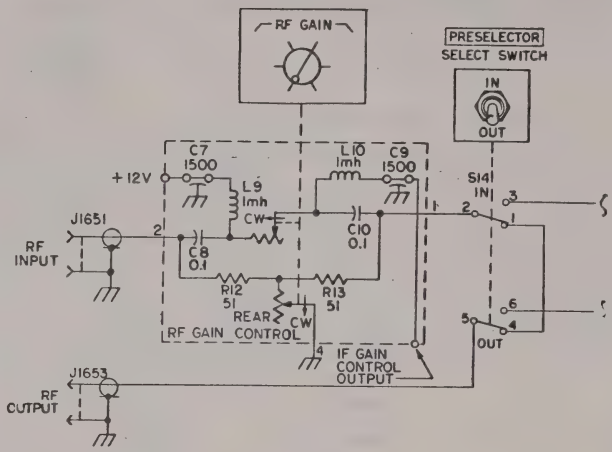
Page 6-9, Circuit Diagram.....Change figure 6-1 as shown below to show new if. Gain Control assembly 724-0260:




Page 6-10, Parts List.....Delete Synthesizer Regulator Assembly RF P/N 724-0232 and add If. Gain Control Assembly RF P/N 724-0260.

*ADDENDUM No.* PM-0910 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPE 238
*APPLICABLE DCN No.(S)*

Page 6-11, Circuit Diagram.....Change figure 6.2 as shown below:




Page 6-12, Parts List.....Make the following additions, changes, and deletions:

Add-C7 Capacitor, Feed-thru, 1500PF, 500 Vdcw: RF P/N C-2651.

Add-C8 Capacitor, Ceramic, Monolythic, 0.1UF+80%-20%: 25 Vdcw: RF P/N C-5066.

Add-C9 Capacitor, Feed-thru, 1500 PF: 500 Vdcw: RF P/N C-2651

Add-C11 Capacitor, Ceramic, Monolythic, 0.1UF+80%-20%; 25 Vdcw: RF P/N C-5066.

Add-L9 Choke, Rf; 1 mH: RF P/N L-0050.

Add-L10 Choke, Rf; 1 mH: RF P/N L-0050.

Add-R12 Resistor, Metal Film; 51 ohms $\pm$ 1%; 1W: RF P/N R-7245.

Add- R13, Resistor, Metal Film; 51 ohms $\pm$ 1%; 1W: RF P/N R-7245.

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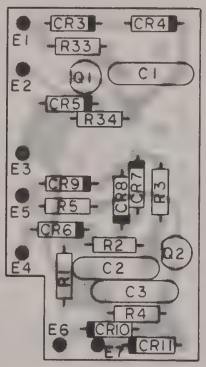
# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0910 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPE 238
*APPLICABLE DCN No.(S)*

Change-RF Gain Control Assembly to RF P/N 724-0163.
Delete-Synthesizer Regulator Board Assembly.
Add-If. Gain Control Assembly; RF P/N 724-0260.

Page 6-13, Circuit Diagrams.....Change figure 6.3 to show new If Gain Control Assembly 724-0260 as shown below. Figure 6.3 is now Figure 6.3-If. Gain Control Assembly Circuit Diagram.




DC VOLTAGES*

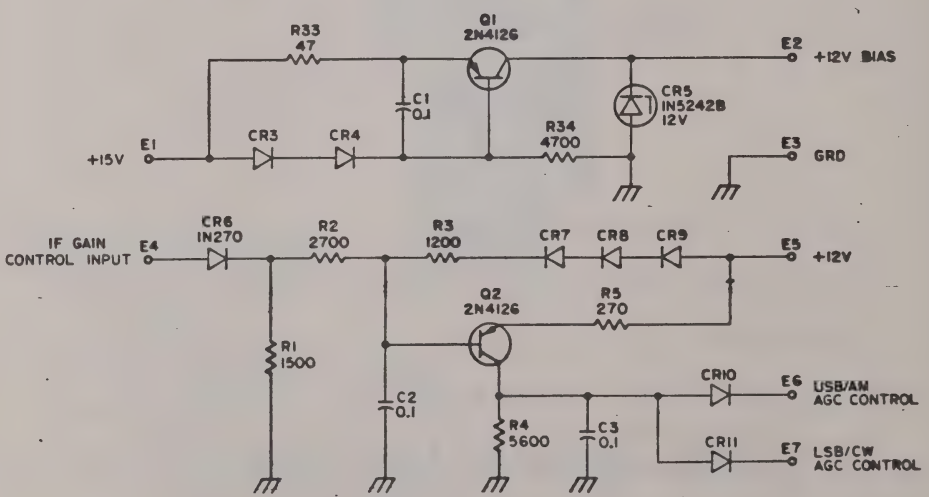
| Stage | E | B | C |
|---|---|---|---|
| Q1 | 11.5V | 13.5V | 11.0V |
| Q2 (note 1) | 12.0V | 11.7V | .0V |
| Q2 (note 2) | 9.4V | 8.8V | 9.4V |

*Referenced to ground

Notes

1. RF Gain control fully clockwise.
2. RF Gain control fully counterclockwise.

ADDENDUM No. PM-0910 APPLICABLE TO: RF-505
APPLICABLE SDN No.(S) MPE 238
APPLICABLE DCN No.(S)




NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL DIODES ARE IN4454
ALL RESISTANCES ARE IN OHMS
ALL CAPACITANCES ARE IN MICROFARADS

Figure 6.3 If. Gain Control Assembly Circuit Diagram.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0910 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPE 238
*APPLICABLE DCN No.(S)*

Page 6-14, Parts List.....Delete Synthesizer Regulator Board Assembly and add If. Gain Control Assembly 724-0260 parts list as shown below:

IF. GAIN CONTROL ASSEMBLY
724-0260

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Ceramic, Monolythic, 0.1UF+80%-20%; 25 Vdcw. | C-5066 |
| C2 | Capacitor, Ceramic, Monslythic, 0.1UF+80%-20%; 25Vdcw. | C-5066 |
| C3 | Capacitor, Ceramic, Monolytic,0.1UF+80%-20%; 25 Vdcw. | C-5066 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Zener Type 1N5242B/(12V) | CR-0261 |
| CR6 | Diode, Silicon, Type 1N270 | CR-0047 |
| CR7 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR8 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR9 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR10 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR11 | Diode, Silicon, Type 1N4454 | CR-0705 |
| Q1 | Transistor, Silicon,General Purpose, PNP, Type 2N4126. | Q-0386 |
| Q2 | Transistor, Silicon,General Purpose,PNP, Type 2N4126. | Q-0386 |
| R1 | Resistor,Carbon;1500 ohms ± 10%;1/4 W | R-0026 |
| R2 | Resistor,Carbon;2700 ohms ± 10%;1/4 W | R-0029 |
| R3 | Resistor,Carbon;1200 ohms ± 10%;1/4 W | R-0025 |
| R4 | Resistor,Carbon;5600 ohms ±10%;1/4 W | R-0033 |
| R5 | Resistor,Carbon;270 ohms ± 10%;1/4 W | R-0017 |
| R33 | Resistor,Carbon;47ohms ± 10%;1/4 W | R-0008 |
| R34 | Resistor,Carbon;4700ohms ±10% 1/4 W | R-0032 |

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0799 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPES-47 724-0800 Assembly
*APPLICABLE DCN No.(S)*

The Second L.O. Generator Assembly, 724-0800, has been modified to improve the performance of the RF-505 Receiver. Make the following changes in Instruction Manual PM-0711.

Page 8-35, Circuit Diagram.

Change C17 to 100 PF. Add C62 (5PF) across pads of L5.

Page 8-36, Parts List.

Change C17 to Capacitor, Ceramic, Disc, Temperature Compensating, 100 PF ± 2%, RF P/N C-4050. Add C62, Capacitor, Mica, 5 PF ± 5%; 500 Vdcw, RF P/N C-0103.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0795
APPLICABLE SDN No.(S) MPES-38, 39, and 40
APPLICABLE DCN No.(S) MPE-
APPLICABLE TO: RF-505 and RF-506 Noise Blanker Assembly

The RF-506 Noise Blanker Assembly has been added to the line of accessories for the RF-505 Receiver. Update Instruction Manual PM-0711 in the following manner to include the RF-506.

Page 1-3/1-4, Table 1.2

RF Part No. for RF-506 Noise Blanker is 724-1300. Attach RF-506 Noise Blanker Instruction Sheet PM-0796 supplied with this addendum to the back of page 1-3/1-4.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0793
*APPLICABLE SDN No.(S)* MPES-45
*APPLICABLE DCN No.(S)*

*APPLICABLE TO:* RF-505 Manual Addendum PM-0780

Delete all references to R23 and R24 in Instruction Manual Addendum PM-0780.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0789 APPLICABLE TO: RF-505
APPLICABLE SDN No.(S)
APPLICABLE DCN No.(S) MPE-227

The agc threshold on the RF-505 Receiver has been increased to 10 uVrms to decrease antenna noise during pauses in speech. If the RF-505 is used for FSK reception,however, it may be desireable to set the agc threshold at 5 uVrms to provide a flatter agc response. Make the following changes in Instruction Manual PM-0711.

Page 1-2, AUTOMATIC GAIN CONTROL (AGC)

Change THRESHOLD: to "Nominal 10 microvolt rms signal at J1 for voice reception. Nominal 5 microvolt rms signal at J1 for FSK reception." Change LOOP ERROR: to "Less than 12 dB change in audio output for input variations between 10.0 microvolts rms to 500 millivolts rms at J1."

Page 2-5, Paragraph 2.6.2

Add the following note right after the paragraph heading.

NOTE

If the RF-505 Receiver is to be used for FSK reception, set agc threshold to 5 microvolts according to paragraph 7.5.3 steps 22, 23, 28, and 29.

Page 3-4, Paragraph 3.3.3

Add the following for paragraph 3.3.3. "3.3.3 FSK OPERATION It may be desireable to set the agc threshold at 5.0 microvolts for FSK operation. Refer to Receiver Module Alignment Procedures, paragraph 7.5.3, steps 22, 23, 28, and 29. The receiver may then be operated in the same manner as in paragraph 3.3.1."

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0788
*APPLICABLE SDN No.(S)* MPES-42
*APPLICABLE DCN No.(S)* MPE-226

*APPLICABLE TO:* RF-505 (724-1200 Assembly)

The Detector/AGC Assembly, 724-1200, has been modified to improve the performance of the RF-505 Receiver. Make the following changes in Instruction Manual PM-0711 to document this modification.

Page 7-25, Detector/AGC Assembly Circuit Diagram

Delete connection between resistor R41 and the +12V line. Add resistor R56 (220 Ohms) between R41 and the +12V line. Add capacitor C41 (47 UF) from junction of R41 and R56 to ground; positive end toward R56.

Page 7-26, Detector/AGC Assembly Parts List

Add C41, Capacitor, Tantalum, 47 UF ± 20%; 20 Vdcw, RF P/N C-2171. Add R56, Resistor, Carbon, 220 Ohms ± 10%, 1/4W, RF P/N R-0016.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0783 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPES-41 (724-0650 Assembly)
*APPLICABLE DCN No.(S)*

The VHF VCO Assembly, 724-0650, in the RF-505 Receiver has been modified by the addition of a filter network which attenuates any 25 kHz spurs in the assembly. Make the following changes in Instruction Manual PM-0711 to document this modification.

Page 8-29, VHF VCO Assembly Circuit Diagram

Delete connection between R9 and R26. Add R31 (1K) in series between R8 and R9. Add C40 (1.0 UF) from junction of R31 and R9 to ground. Add connection between Q6 emitter and junction of R31 and R8.

Page 8-30, VHF VCO Assembly Parts List

Under VHF VCO Phase Filter Sub-assembly, 724-0660; add C40, Capacitor, Tantalum, Polar, 1.0 UF $\pm$ 20%; 25 Vdcw, RF P/N C-6291 and R31, Resistor, Carbon, 1K $\pm$ 10%; 1/4W, RF P/N R-0024.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0781 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPES-36 (724-0650 Assembly)
*APPLICABLE DCN No.(S)*

The RF-505 Receiver has been modified by the substitution of metal film resistors in place of some carbon resistors on the VHF VCO Assembly, 724-0650. This modification reduces the possibility of noise generation in the VHF VCO and improves operation of the receiver. Make the following changes in Instruction Manual PM-0711 to document the modification.

Page 8-29, VHF VCO Assembly Circuit Diagram

724-0660 Assy...Change R5, R9, R27, R28 and R29 to 2670 ohms. Change R3 to 681 ohms, R6 to 8250 ohms, and R7 to 475 ohms.

724-0670 Assy...Change R1, R2, R3, R4, R5, and R6 to 5620 ohms. Change R7, R8, and R9 to 825 ohms.

Page 8-30, VHF VCO Assembly Parts List

724-0650...Change R27, R28, and R29 to Resistor, Metal Film, 2670 ohms ± 1%; 1/8W, RF P/N R-7299.

724-0660 Assy...Change R3 to Resistor, Metal Film, 681 ohms ± 1%; 1/8W, RF P/N R7297. Change R6 to Resistor, Metal Film, 8250 ohms ± 1%; 1/8W, RF P/N R-7301. Change R7 to Resistor, Metal Film, 475 ohms ± 1%, 1/8W, RF P/N R-7296.

724-0670 Assy...Change R1,R2, R3, R4, R5, and R6 to Resistor, Metal Film, 5620 ohms ± 1%, 1/8W, RF P/N R-7300. Change R7, R8 and R9 to Resistor, Metal Film, 825 ohms ± 1%, 1/8W, RF P/N R-7298.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0780 *APPLICABLE TO:* RF-505 (Power Supply Module)
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)* MPE-215

The Power Supply Module in the RF-505 Receiver has been modified to reduce input power and prevent overheating during 230 Vac operation. Make the following changes in Instruction Manual PM-0711.

Page 9-11, Power Supply Module Circuit Diagram.

Change C2 to 2900 UF. Change R28 to 560 Ohms. Change R23 and R24 to 180 Ohms. Add C33 (0.02 UF) across R23. Add C34 (0.02 UF) across R24. Add R44 (10 Ohms) across Q11 base to emitter. Add R45 (10 Ohms) across Q12 base to emitter. Delete CR15 and CR16. Change CR10 and CR13 to 1N4936. Change CR11 and CR12 to 1N4935.

Page 9-12, Power Supply Module Parts List, 724-1500.

Change C2 to 2900 UF, 50 VDCW, RF P/N C-4001. Delete CR15 and CR16. Change CR10 and CR13 to 1N4936, RF P/N CR-0281. Change CR11 and CR12 to 1N4935, RF P/N CR-0280.

Page 9-12, Power Supply Board Assembly, 724-1520.

Change R28 to 560 Ohms, 1W, RF P/N R-0221. Change R23 and R24 to 180 Ohms, 1/4W, RF P/N R-0015. Add R44 and R45, Resistor, Carbon, 10 Ohms $\pm$ 10%, 1/4W, RF P/N R-0000. Add C33 and C34, Capacitor, Ceramic, 0.02 UF +60% -40%, 150 VDCW, RF P/N C-0066.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0778
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)*

*APPLICABLE TO:* RF-505
(Main Frame)

The ac fuse (F1) on the front panel of the RF-505 Receiver has been changed to a Slo-Blo type fuse. Make the following changes in Instruction Manual PM-0711.

Page 6-10, Main Frame Parts List

Change F1 to Slo-Blo, RF P/N F-0027.

Page 1-3, Table 1.2

Change the 1A fuse to RF P/N F-0027.
Delete the 1.5A fuse.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0773
APPLICABLE SDN No.(S)
APPLICABLE DCN No.(S)

APPLICABLE TO: RF-505
(724-0300 Assembly)

## GENERAL

The VHF Filter Assembly, 724-0300, has been added to the RF-505 Receiver to improve spurious signal rejection. This assembly consists of a 156.5 MHz band-pass filter network for the local oscillator number two output of the synthesizer module, and a 156.0 to 186.0 MHz band-pass filter network combined with a 156.0 MHz notch filter for the local oscillator number one output of the synthesizer module. The 156.5 MHz filter attenuates all signals above and below 156.5 MHz. The 156.0 to 186.0 MHz filter attenuates all signals above 186.0 MHz and below 156.0 MHz. When the receiver is operated above 10.0 MHz, the 156.0 MHz notch filter is activated, and attenuates any 156.0 MHz signals.

NOTE

Refer to figures 1 and 2 during assembly removal.

## ASSEMBLY REMOVAL

To remove the VHF Filter from the RF-505 chassis, perform the following procedures:

1. Loosen the four captive screws at each corner of the Receiver Module and slide the module toward the rear of the receiver.

2. Tag and unsolder wires connected to E1, E2, and E3 of the VHF Filter.

3. Disconnect P-0301, P-0302, P-0303, and P-0304 on the VHF Filter.

4. Remove hardware securing VHF Filter to receiver chassis and remove assembly.

ADDENDUM No.

APPLICABLE TO:

APPLICABLE SDN No.(S)

APPLICABLE DCN No.(S)

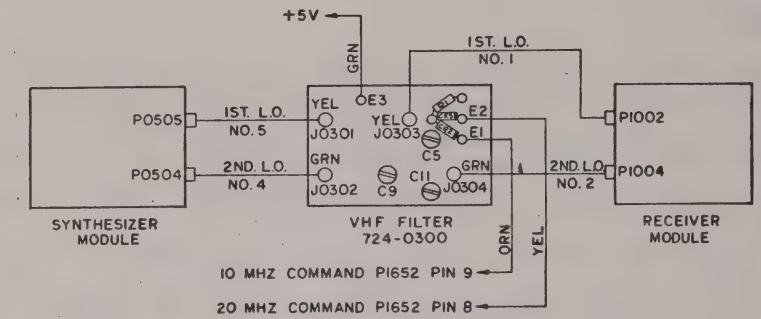
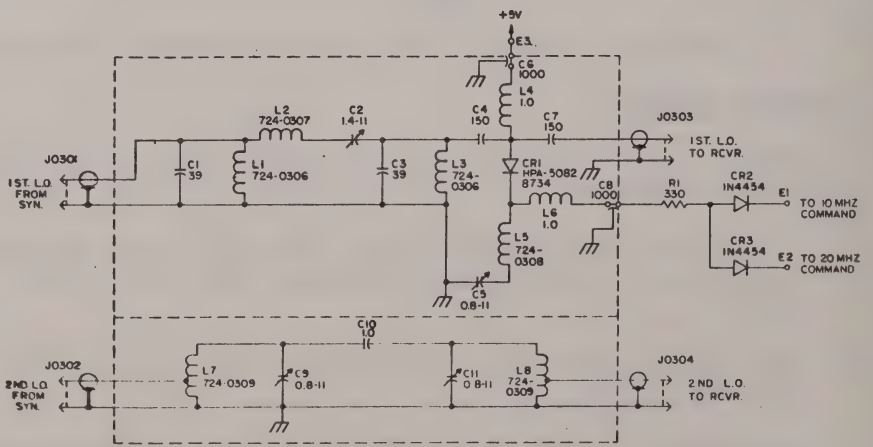



FIGURE 1




NOTES:

1. ALL CAPACITANCES ARE IN PICOFARADS, ALL INDUCTANCES ARE IN MICROHENRIES, RESISTANCES ARE IN OHMS.
2. LAST DESIGNATORS:
   C8
   CR3
   L8
   R1

FIGURE 2

*ADDENDUM No.* *APPLICABLE TO:*
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)*

NOTE

Refer to figures 1 and 2 during assembly installation.

ASSEMBLY INSTALLATION

To install the VHF Filter in the RF-505, perform the following procedures:

1. Secure VHF Filter to receiver chassis with hardware.
2. Connect P-0301, P-0302, P-0303, and P-0304 to appropriate connectors on the assembly.
3. Solder tagged wires to the appropriate terminals on the VHF Filter.
4. Slide Receiver Module toward front of RF-505 to engage connector and secure with four captive screws at each corner of the Receiver Module.

ALIGNMENT

To align the VHF Filter assembly perform the following procedures:

1. Follow assembly removal instructions and remove VHF Filter assembly from receiver chassis.
2. At receiver front panel, set controls for usb operation at 6.00000 MHz.
3. Connect P-0301 to J-0301.
4. Connect rf vtvm with 50 ohm termination to J-0303.

5. Adjust C2 for a peak indication on the rf vtvm.

6. Remove all connections from VHF Filter assembly.

7. Follow assembly installation instructions and install VHF Filter assembly on receiver chassis.

8. Disconnect P-0303 from J-0303 and connect rf vtvm to J-0303.

9. At receiver front panel, set FREQUENCY MHz controls at 0.00000 MHz.

10. Ground junction of CR2, CR3, and R1.

11. Adjust C5 for a null indication on the rf vtvm.

12. Unground junction of CR2, CR3, and R1.

13. Disconnect rf vtvm from J-0303 and connect P-0303 to J-0303.

14. Disconnect J-0304 from J-0304 and connect rf vtvm to J-0304.

NOTE

There is normally marked interaction between the adjustments of C9 and C1. Both adjustments must be repeated until no further increase in output is indicated.

15. Adjust C9 and C1 for a peak indication on the rf vtvm.

16. Disconnect rf vtvm from J-0304 and connect P-0304 to J-0304.

ADDENDUM No. APPLICABLE TO:
APPLICABLE SDN No.(S)
APPLICABLE DCN No.(S)

PARTS LIST

| REF DESIG | DESCRIPTION | RF P/N |
|---|---|---|
| C1 | Capacitor, Mica, 39 PF ± 5%; 500 Vdcw | C-0115 |
| C2 | Capacitor, Air, Variable 1.5 - 11.6 PF | C-1355 |
| C3 | Capacitor, Mica, 39 PF ± 5%; 500 Vdcw | C-0115 |
| C4 | Capacitor, Ceramic, Disk, 150 PF ± 20% 100 Vdcw | C-2263 |
| C5 | Capacitor, Variable, 0.8 - 11.0 PF | C-2178 |
| C6 | Capacitor, Feedthru, 1000 PF | C-4327 |
| C7 | Capacitor, Ceramic, Disk, 150 PF ± 20%; 100 Vdcw | C-2263 |
| C8 | Capacitor, Feedthru, 1000 PF | C-4327 |
| C9 | Capacitor, Variable, 0.8-11.0 PF | C-2178 |
| C10 | Capacitor, Mica, 10 PF ± 5%; 500 Vdcw | C-0100 |
| C11 | Capacitor, Variable, 0.8-11.0 PF | C-2178 |
| CR1 | Diode, Pin, Type H.P. No. 5082-8734 | 724-1113 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| J-0301 | Connector, Coaxial, Male | J-0030 |
| J-0302 | Connector, Coaxial, Male | J-0030 |
| J-0303 | Connector, Coaxial, Male | J-0030 |
| J-0304 | Connector, Coaxial, Male | J-0030 |

*ADDENDUM No.* *APPLICABLE TO:*
*APPLICABLE SDN No.(S)*
*APPLICABLE DCN No.(S)*

PARTS LIST CONTINUED:

| REF DESIG. | DESCRIPTION | RF P/N |
|---|---|---|
| L1 | Coil, Rf | 724-0306 |
| L2 | Coil, Rf | 724-0307 |
| L3 | Coil, Rf | 724-0306 |
| L4 | Coil, Rf, 1.0 UH | L-0616 |
| L5 | Coil, Rf | 724-0308 |
| L6 | Coil, Rf | L-0616 |
| L7 | Coil, Rf | 724-0309 |
| L8 | Coil, Rf | 724-0309 |
| R1 | Resistor, Carbon; 330 Ohms $\pm$ 10%; 1/4W | R-0018 |

INSTRUCTION MANUAL REVISION

Add the material contained in this addendum to Instruction Manual PM-0711. Refer to figure 1 and revise the Main Frame schematic diagram to include the VHF Filter assembly, 724-0300.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No. PM-0764
APPLICABLE SDN No.(S) N/A
APPLICABLE DCN No.(S) MPE-208
APPLICABLE TO: RF-505

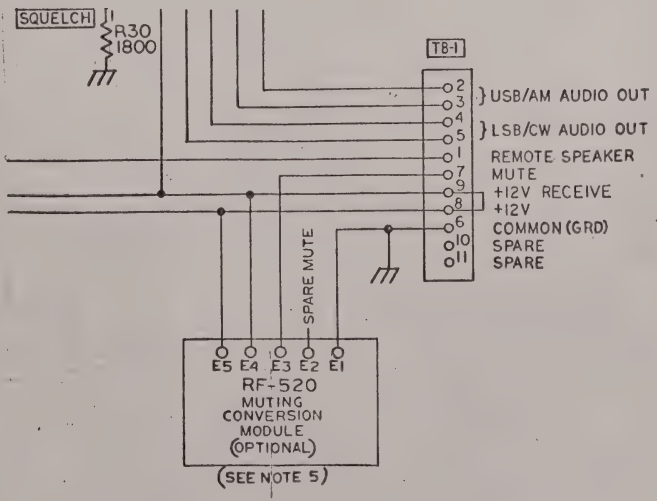
The RF-520 Muting Conversion Module has been added to the line of accessories for the RF-505 ISB Receiver. Update your Instruction Manual PM-0711 in the following manner to include the RF-520 Muting Conversion Module.

Page 6-9, RF-505 Main Frame Schematic Diagram, 724-0100

Add note 5: "Jumper on TB-1 between terminals 8 and 9 must be removed when optional RF-520 is used." Add RF-520 to schematic diagram as shown in figure 1.

Page 1-3/1-4, Table 1.2

RF PART NO. for RF-520 Muting Conversion Module is 724-0240. Attach RF-520 Muting Conversion Module Instruction Sheet, PM-0765, supplied with this addendum to back of page 1-3/1-4.



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# INSTRUCTION MANUAL ADDENDUM

| | | | |
|---|---|---|---|
| *ADDENDUM No.* | PM-0761 | *APPLICABLE TO:* | RF-505 |
| *APPLICABLE SDN No.(S)* | | | (724-0110 Assembly) |
| *APPLICABLE DCN No.(S)* | MPE-198 and 211 | | (724-1520 Assembly) |

The RF-505 ISB Receiver has been modified to improve operation. Make the following changes in Instruction Manual PM-0711.

Page 6-9, Main Frame Schematic Diagram, 724-0110.

Change R24 to 680 Ohms.

Page 6-10, Main Frame Parts List, 724-0110.

Change R24 to 680 Ohms, RF P/N R-0022.

Page 9-12, Power Supply Board Assembly Parts List, 724-1520.

Change R28 to 2W, RF P/N R-0316.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0760 *APPLICABLE TO:* RF-505
*APPLICABLE SDN No.(S)* MPES-31
*APPLICABLE DCN No.(S)* MPE-198, 201, 202, 203

The RF-505 ISB Receiver has been modified to improve performance. Revise your Instruction Manual PM-0711 to reflect the following changes.

Text:

Page 1-3/1-4, table 1.2....RF Part No. for RF-511 Remote Monitor Speaker is 724-0200, for RF-518 Earphones is 724-0075, and for RF-521 Suitcase Carrying Case is 724-0068.

Page 7-2, paragraph 7.2.3.b....Change reference to pin H to pin M. Change reference to pin J to pin N.

Page 7-3, paragraph 7.2.3.h....Change R24 to R20. Paragraph 7.2.3.i; change references to pin U to pin A.

Page 7-4, paragraph 7.2.5....Change CR4 to CR1.

Page 8-1; right column, first paragraph, line seven....Change A2-C to A2-D.

Speaker Driver and Squelch Gate Assembly, 724-1250:

Page 7-27, Circuit Diagram....Add capacitor C10(0.1 UF) across pins 7 and 8 of A1.

Page 7-28, Parts List....Add C10, Capacitor, Ceramic Disk, 0.1 UF $\pm$ 20%; 30 VDCW, RF P/N C-2210.

Translator, 724-0850:

Page 8-37, Circuit Diagram....Add note 3: ON EARLY PRODUCTION MODELS R33 WAS 1K.

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# INSTRUCTION MANUAL ADDENDUM

ADDENDUM No PM-0751
APPLICABLE SDN No.(S) MPES-30
APPLICABLE DCN No.(S) MPE-197
APPLICABLE TO: RF-505 & PM-0748

The RF-505 Receiver has been modified to improve performance. Revise Instruction Manual PM-0711 and Instruction Manual Addendum PM-0748 as described below.

Instruction Manual Addendum PM-0748:

Delete all instructions pertaining to 14MHz Up-Mixer and VFO Assembly, 724-0900, except first sentence referring to R16.

Instruction Manual Addendum PM-0711:

Page 8-29, VHF VCO Assembly Circuit Diagram....Add resistor R30 (1K) to 724-0660 assembly as shown in figure 1.

Page 8-30, VHF VCO Assembly Parts List....On 724-0660 assembly, add R30, Resistor, Carbon, 1K ± 10%, 1/4W, RF P/N R-0024. On 724-0670 assembly, add C7, C8, and C9, Capacitor, Variable, 0.8-10.0 PF, RF P/N C-2178.

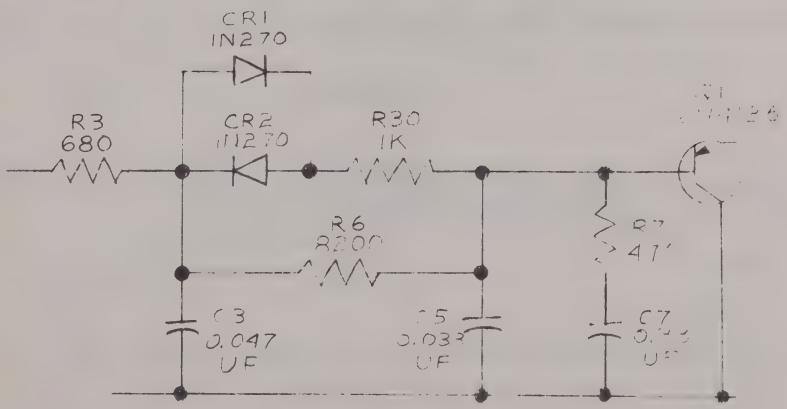


Figure 1

ADDENDUM No.

APPLICABLE TO:

APPLICABLE SDN No.(S)

APPLICABLE DCN No.(S)

Page 7-21, Front End Assembly Schematic Diagram....Change schematic diagram as shown in figure 2. Change R19 to 1800 ohms.

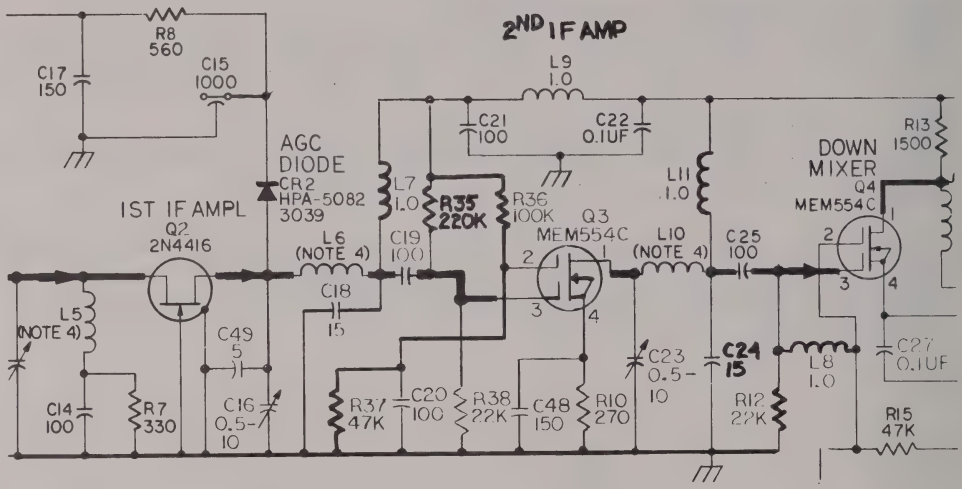


FIGURE 2

Page 6-3, Table 6.8 - VHF VCO Steering Voltage....Change the voltage readings to the following:

0.89
1.12
1.43
1.78
2.37
3.00
4.03
5.10
7.00
9.35

# *REPAIR SERVICE*

## INSTRUCTION ADDENDUM

A second "Request for Repair Service" form (PM-0738) should be completed and forward by air mail to:

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For those sub-assemblies being returned for repair from users located outside the United States - Forward to:

RF COMMUNICATIONS, INC.
MPE REPAIR SERVICE DEPARTMENT
C/O ASSOCIATED CUSTOMHOUSE BROKERS
39 STATE STREET
ROCHESTER, NEW YORK
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Mark each package - "U.S. Goods Returned for Repair"

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0748 *APPLICABLE TO:* RF-505 ISB Receiver
*APPLICABLE SDN No.(S)* MPES-15, 17, 18, 19, 20, 21, 25, 26, 29
*APPLICABLE DCN No.(S)* MPE-169, 170, 172, 175, 178, 180, 182,-187, and 190.

The RF-505 ISB Receiver has been modified to improve performance. Revise your Instruction Manual PM-0711 to reflect the following changes.

Text:

Page 2-6, figure 2.3....Change F1 to F2 to agree with Main Frame circuit diagram.

RF-505 Main Frame, 724-0110:

Page 6-9, Circuit Diagram....Add capacitor, C3(0.01 UF) from J3 pin A to ground. Add capacitor, C4(0.01 UF) from J3 pin C to ground. Add capacitor, C5(0.01 UF) from J4 pin A to ground. Add capacitor, C6(0.01 UF) from J4 pin B to ground.

Page 6-10, Parts List....Add C3-C6, Capacitor, Ceramic, 0.01 UF, 1K Vdcw, RF P/N C-0008.

Synthesizer Module, 724-0500:

Page 8-23, Circuit Diagram....Add capacitors, C1-C14 (470 PF) from the following pins on P0701 to ground.

1. C1 - Pin 3
2. C2 - Pin 12
3. C3 - Pin 11
4. C4 - Pin U
5. C5 - Pin 10
6. C6 - Pin 18
7. C7 - Pin 8
8. C8 - Pin V
9. C9 - Pin 9
10. C10 - Pin 16

ADDENDUM No. PM-0748 APPLICABLE TO: RF-505 ISB Receiver
APPLICABLE SDN No.(S) MPES-15, 17, 18, 19, 20, 21, 25, 26, 29
APPLICABLE DCN No.(S) MPE-169, 170, 172, 175, 178, 180, 182-187, and 190.

11. C11 - Pin 15
12. C12 - Pin 13
13. C13 - Pin 5
14. C14 - Pin 4

Add C15 (0.1 UF) from E35 to ground. Add C16 (0.1 UF) from E16 to ground. Add C17 ( 0.1 UF) from J0501 pin 12 to ground. Add C18 (0.1 UF) from J0501 pin F to ground. Insert L1 (5.6 UH) in +5V line to left of C17. Insert L2 (5.6 UH) in + 12V line to left of C18.

Page 8-24, Parts List....Add the following components.

1. C1 - C14, Capacitor, Ceramic, 470 PF ± 20% RF P/N C-1191
2. C15 - C18, Capacitor, Ceramic, 0.1 UF + 80% - 20% 25 Vdcw, RF P/N C-5066.
3. L1 and L2, Coil, Rf, 5.6 UH, RF P/N L-0331.

HF VCO Assembly, 724-0550:

Page 8-26, Parts List....Delete Socket, 14 pin, Dual in-line.

HF Divider Assembly, 724-0600:

Page 8-27, Circuit Diagram....Delete connection on A7 between pin 3 and pin 14. Add connection on A7 between pin 3 and pin 9.

VHF VCO Assembly, 724-0650:

Page 8-29, Circuit Diagram....Add C37 (0.1 UF) from junction of R27 and C13 to ground. Add C38 (0.1 UF) from junction of R28 and C14 to ground. Add C39 (0.1 UF) from junction of R29 and C19 to ground. On 724-0680 assembly; change

*ADDENDUM No.* PM-0748 *APPLICABLE TO:* RF-505 ISB Receiver
*APPLICABLE SDN No.(S)* MPES-15, 17, 18, 19, 20, 21, 25, 26, 29
*APPLICABLE DCN No.(S)* MPE-169, 170, 172, 175, 178, 180, 182-187, and 190.

C4 to 27 PF, add C5 (27 PF) between C4 and E10, and add L1 from junction of C4 and C5 to ground. Delete C33 connected to E9. Change R31 connected to E6 to C31. On 724-0670 assembly change CR2, CR4, and CR6 to MV 1628.

Page 8-30, Parts List....On 724-0650 assembly delete C33. On 724-0660 assembly; add C37-C39, Capacitor, Ceramic, 0.1 UF + 80% - 20%, 25 Vdcw, RF P/N C-5066, and add R27- R29, Resistor, Carbon; 2700 Ohms ± 10%; 1/4W, RF P/N R-0029. ON 724-0670 assembly; change CR2, CR4, and CR6 to MV 1628, RF P/N CR-0084. On 724-0680 assembly; change C4 to Capacitor, Mica, 27 PF ± 5%; 500 Vdcw, RF P/N C-0111, add C5 with same characterstics as C4, and add L1, Coil, 3 1/2 turns of 24 guage wire, RF P/N 724-0683.

VHF Divider Assembly, 724-0700:

Page 8-31, Circuit Diagram....Change C7 to 30 PF.

Page 8-32, Parts List....On 724-0710 assembly, change C7 to Capacitor, Mica, 30 PF ± 5%; 500 Vdcw, RF P/N C-0112, and change A5 to SF122P-03, RF P/N IC-0025.

Spectrum Generator Assembly, 724-0750:

Page 8-34, Parts List....Delete Socket, 14 pin, Dual in-line.

Second L.O. Generator Assembly, 724-0800:

Page 8-35, Circuit Diagram....Add TP4 to E1. Change C40 to 7-25 PF.

Page 8-36, Parts List....Change C40 to 7-25 PF, RF P/N C-2304 Delete Socket, 14 pin, Dual in-line.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0748 *APPLICABLE TO:* RF-505 ISB Receiver
*APPLICABLE SDN No.(S)* MPES-15, 17, 18, 19, 20, 21, 25, 26, 29
*APPLICABLE DCN No.(S)* MPE-169, 170, 172, 175, 178, 180, 182-187, and 190.

Translator Assembly, 724-0850:

Page 8-37, Circuit Diagram.....Substitute L22 (0.27 UH) for R37. Add C66 (5PF) in parallel with L22. Add C67 (68 PF) in parallel with C32. Change L14 to 8.2 UH. Change C51 to 100 PF. Change C46 to 5PF. Change C60 to 24 PF. Change C40 to 150 PF.

Page 8-38, Parts List....Delete R37. Add C66, Capacitor, Mica, 5 PF ± 5%; 500 Vdcw, RF P/N C-0103. Add C67, Capacitor, Mica, 68 PF ± 5%; 500 Vdcw, RF P/N C-0122. Add L22, Coil, Rf, 0.27 UH, RF P/N L-0608. Change C46 to Capacitor, Mica, 5 PF ± 5%; 500 Vdcw, RF P/N C-0103. Change C40 to Capacitor, Ceramic, Disc, 150 PF ± 20%; 250 Vdcw, RF P/N C-2263. Change C51 to Capacitor, Mica, 100 PF ± 5%; 500 Vdcw, RF P/N C-0126. Change C60 to 24 PF, RF P/N C-0110. Change L14 to 8.2 UH RF P/N L-0627. Delete Socket, 14 pin, Dual in-line.

14 MHz - Up-Mixer and VFO Assembly, 724-0900:

Page 8-39, Circuit Diagram....Change 1K resistor, next to A4, labeled R15 to R16. Add resistor R32 (100 Ohms), from junction of C30 and C31 to ground. Connect legs of potentiometer R33 (500 Ohms) across R32. Delete connection between J0901 pin H and junction of C30 and C31. Connect wiper of R33 to J0901 pin H.

Page 8-40, Parts List....Add R32, Resistor, Carbon; 100 Ohms ± 10% 1/4 W, RF P/N R-0012. Add R33, Resistor, Variable, 500 Ohms ± 10%, RF P/N R-7206.

Filter Assembly, 724-1150/1175:

Page 7-23, Circuit Diagram....Change R5 to 220 Ohms.

Page 7-24, Parts List....Change R5 to 220 Ohms, RF P/N R-0016.

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# INSTRUCTION MANUAL ADDENDUM

*ADDENDUM No.* PM-0748 *APPLICABLE TO:* RF-505 ISB Receiver
*APPLICABLE SDN No.(S)* MPES-15, 17, 18, 19, 20, 21, 25, 26, 29
*APPLICABLE DCN No.(S)* MPE-169, 170, 172, 175, 178, 180, 182-187, and 190.

Speaker Driver and Squelch Gate Assembly, 724-1250:

Page 7-27, Circuit Diagram....Substitute inductor L1 (27 UH) for F1.

Page 7-28, Parts List....Delete F1. Add L1, Coil, Rf, 27 UH, RF P/N L-0227.

Power Supply Module, 724-1500:

Page 9-11, Circuit Diagram,....Add Capacitor, C32 (0.1 UF) from P1521 pin D to ground.

Page 9-12, Parts List....On 725-1500 assembly, add C32, Capacitor, 0.1 UF + 80% - 20%; 25 Vdcw, RF P/N C-5066.

# RF COMMUNICATIONS
# SUB-ASSEMBLY REPAIR SERVICE

RF Communications offers a sub-assembly repair service which provides a fast, reliable means of repairing printed card sub-assemblies which are inoperable or out of specifications.

To obtain this quick repair service the customer must fill out the "Request for Repair Services" form (PM-0738) provided as part of the Ancillary Kit. This form is then inserted in the mailer carton (which is also part of the kit) along with the faulty card and forwarded to:

**RF COMMUNICATIONS, INC.**
**1680 UNIVERSITY AVENUE**
**ROCHESTER, NEW YORK**
**USA 14610**

**CAUTION**

*Be sure to use the air cap packing provided and seal the carton tightly. RF Communications cannot be responsible for damage or loss in transit.*

**NOTICE**

*If time is of the essence, a telephone call to RF Communications (716-244-5830 MPE Operation Repair Service Dept.) will result in a replacement card being shipped in less than 24 hours.*

RF Communications will immediately mail prepaid a replacement card from stock upon receipt of the faulty card or upon verbal request.

The customer will be billed for the full list price of the replacement card; RF will provide a credit upon receipt of the faulty card, so that the final price the customer will be charged is only the net cost shown on the current price schedule. The customer may alternatively specify that the repairs be done on a quote basis.

RF Communications provides this service subject to the following conditions: 1. that returned material has failed under normal use when used for the purpose for which it was designed; 2. that any material returned to RF COMMUNICATIONS is in factory condition and has not been tampered with in attempting to repair; and 3. the material returned has not been damaged or broken. RF Communications warrants the equipment purchased under this service to be free of defect in material and workmanship for 30 days.

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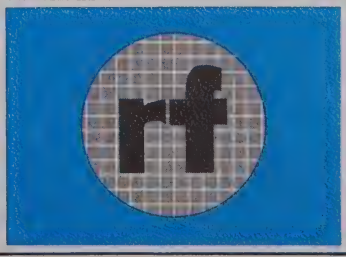

# R F COMMUNICATIONS, INC.

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## REQUEST FOR REPAIR SERVICES

SERIAL NO. OF EQUIPMENT REMOVED FROM: _____

PART NO. OR NAME: _____

I hereby authorize RF COMMUNICATIONS to send me a replacement for the enclosed sub-assembly and to bill me in accordance with the latest price schedule.

NAME _____

TITLE _____

ADDRESS _____

_____

ZIP CODE _____

RETURN EQUIPMENT TO:

FOLD ----- ----- FOLD

_____

_____

_____

_____

ZIP CODE _____

## QUALITY INFORMATION

History of failure and description: (explicit information pertaining to temperature, vibration and conditions of usage would be helpful).

_____

_____

_____

Approximate length of service: _____ days / hours

COMMENTS: _____

_____

Write on back if more space is needed.

FORM PM-0738

# TABLE OF CONTENTS


| CHAPTER | | PAGE |
|---|---|---|
| 1 | GENERAL DESCRIPTION | 1-1 |
| | 1.1 Scope of Instruction Manual | 1-1 |
| | 1.2 Description | 1-1 |
| | 1.3 Purpose and Uses | 1-1 |
| | 1.4 Technical Specifications | 1-1 |
| | 1.5 Accessories and Spares | 1-3 |
| 2 | INSTALLATION | 2-1 |
| | 2.1 General | 2-1 |
| | 2.2 Unpacking and Inspection | 2-1 |
| | 2.3 Site Selection | 2-1 |
| | 2.4 Antennas and Transmission Lines | 2-1 |
| | 2.5 Installation | 2-2 |
| | 2.6 Connections | 2-4 |
| 3 | OPERATION | 3-1 |
| | 3.1 General | 3-1 |
| | 3.2 Operating Controls, Indicators, and Connectors | 3-1 |
| | 3.3 Operating Instructions | 3-4 |
| 4 | THEORY OF OPERATION | 4-1 |
| | 4.1 General | 4-1 |
| | 4.2 Description | 4-1 |
| | 4.3 RF-505 Receiver Block Diagram Theory | 4-1 |
| | 4.4 Receiver Module | 4-3 |
| | 4.5 Synthesizer Module | 4-7 |
| 5 | MAINTENANCE | 5-1 |
| | 5.1 General | 5-1 |
| | 5.2 Preventative Maintenance | 5-1 |
| | 5.3 Performance Test | 5-1 |
| | 5.4 Fault Analysis Table | 5-5 |
| | 5.5 Modules Removal | 5-7 |
| | 5.6 Module Replacement | 5-7 |
| | 5.7 Printed Circuit Assemblies | 5-8 |
| 6 | MAIN FRAME AND PRE-SELECTOR MODULE | 6-1 |
| | 6.1 General | 6-1 |
| | 6.2 Frequency MHz Switches Check | 6-1 |
| | 6.3 Steering Voltage Checks | 6-3 |
| | 6.4 Preselector and RF Gain Control Test | 6-3 |
| | 6.5 VFO Tracking Alignment | 6-5 |
| | 6.6 Circuit Diagrams and Parts Lists | 6-7 |
| 7 | RECEIVER MODULE | 7-1 |
| | 7.1 General | 7-1 |
| | 7.2 Detailed Theory of Operation | 7-1 |
| | 7.3 Performance Checks | 7-4 |
| | 7.4 Fault Analysis | 7-4 |
| | 7.5 Alignment Procedures | 7-11 |
| | 7.6 Circuit Diagrams and Parts Lists | 7-17 |
| 8 | SYNTHESIZER MODULE | 8-1 |
| | 8.1 General | 8-1 |
| | 8.2 Detailed Theory of Operation | 8-1 |
| | 8.3 Performance Checks | 8-7 |
| | 8.4 Fault Analysis | 8-8 |
| | 8.5 Alignment Procedures | 8-16 |
| | 8.6 Circuit Diagrams and Parts Lists | 8-21 |
| 9 | POWER SUPPLY MODULE | 9-1 |
| | 9.1 General | 9-1 |
| | 9.2 Theory of Operation | 9-1 |
| | 9.3 Test and Alignment Procedures | 9-4 |
| | 9.4 Fault Analysis | 9-6 |
| | 9.5 Circuit Diagram and Parts List | 9-9 |

## TABLE OF CONTENTS (Cont.)


| CHAPTER | | PAGE |
|---|---|---|
| 10 | FREQUENCY STANDARD MODULE | 10-1 |
| 10.1 | General | 10-1 |
| 10.2 | Theory of Operation | 10-1 |
| 10.3 | Test and Alignment | 10-1 |
| 10.4 | Fault Analysis | 10-3 |
| 10.5 | Circuit Diagram and Parts List | 10-5 |
| APPENDIX | | A-1 |


# LIST OF ILLUSTRATIONS


| FIGURE | | PAGE |
|---|---|---|
| 1.1 | Top and End View of RF-505 Receiver | 1-3 |
| 2.1 | Typical Doublet Antenna Installation | 2-3 |
| 2.2 | RF-505 Rack Installation | 2-4 |
| 2.3 | Typical Antenna and Terminal Unit Connections | 2-6 |
| 3.1 | RF-505 Front Panel | 3-1 |
| 4.1 | RF-505 Receiver Block Diagram | 4-2 |
| 4.2 | RF-505 Receiver Module Block Diagram | 4-5 |
| 4.3 | RF-505 Synthesizer Module Block Diagram | 4-6 |
| 5.1 | RF-505 Top View (Cover Removed) | 5-8 |
| 5.2 | RF-505 Shown With an Assembly Extended for Testing | 5-9 |
| 6.1 | RF-505 Receiver Main Frame Circuit Diagram | 6-9 |
| 6.2 | Preselector Module Circuit Diagram | 6-11 |
| 6.3 | Synthesizer Regulator Assembly Circuit Diagram | 6-13 |
| 7.1 | Front End Assembly Test Set-up | 7-11 |
| 7.2 | Receiver Module Circuit Diagram | 7-19 |
| 7.3 | Front End Assembly Circuit Diagram | 7-21 |
| 7.4 | Filter Assembly Circuit Diagram | 7-23 |
| 7.5 | Detector/AGC Assembly Circuit Diagram | 7-25 |
| 7.6 | Speaker Driver and Squelch Gate Assembly Circuit Diagram | 7-27 |
| 8.1 | Synthesizer Module Circuit Diagram | 8-23 |
| 8.2 | HF VCO Assembly Circuit Diagram | 8-25 |
| 8.3 | HF Divider Assembly Circuit Diagram | 8-27 |
| 8.4 | VHF VCO Assembly Circuit Diagram | 8-29 |
| 8.5 | VHF Divider Assembly Circuit Diagram | 8-31 |
| 8.6 | Spectrum Generator Assembly Circuit Diagram | 8-33 |
| 8.7 | Second L.O. Generator Assembly Circuit Diagram | 8-35 |
| 8.8 | Translator Assembly Circuit Diagram | 8-37 |
| 8.9 | 14 MHz Up-Mixer and VFO Assembly Circuit Diagram | 8-39 |
| 9.1 | Power Supply Block Diagram | 9-2 |
| 9.2 | Power Supply Waveforms | 9-4 |
| 9.3 | Fabricated Test Circuit | 9-6 |
| 9.4 | Component Locations, Top View | 9-7 |
| 9.5 | Component Locations, Side View | 9-7 |
| 9.6 | Power Supply Module Circuit Diagram | 9-11 |
| 10.1 | Frequency Standard Module 724-1600 | 10-1 |
| 10.2 | Terminal E4 Waveform | 10-3 |
| 10.3 | Frequency Standard Module Circuit Diagram | 10-7 |

## LIST OF ILLUSTRATIONS (Cont.)


| FIGURE | | PAGE | FIGURE | | PAGE |
|---|---|---|---|---|---|
| APPENDIX | | | | | |
| 1 | Circuit Diagrams for IC-0010 and IC-0011 | A-2 | 5 | Circuit Diagrams for IC-0020 and IC-0023 | A-4 |
| 2 | Circuit Diagrams for IC-0013 and IC-0014 | A-2 | 6 | Circuit Diagrams for IC-0024 and IC-0030 | A-5 |
| 3 | Circuit Diagrams for IC-0016 and IC-0017 | A-3 | 7 | Circuit Diagrams for IC-0035 and IC-0036 | A-6 |
| 4 | Circuit Diagrams for IC-0018 and IC-0019 | A-3 | 8 | Circuit Diagrams for IC-0037 and 724-1260 | A-7 |

# CHAPTER 1
# GENERAL DESCRIPTION

## 1.1 SCOPE OF INSTRUCTION MANUAL

This instruction manual contains the information necessary to install, operate, and maintain the model RF-505 Receiver.

## 1.2 DESCRIPTION

The RF-505 Receiver, shown on the front cover, is a high quality, general purpose receiver. Full specified performance is provided over the medium and high frequency range of 1.6 to 30.0 megahertz (MHz) with modes of operation including upper sideband (usb), lower sideband (lsb), amplitude modulation (am.), continuous wave (cw), and independent sideband (isb). Fully synthesized, the RF-505 Receiver can be digitally set to within 100 Hz of any frequency up to 29.9999 MHz. Continuous tuning is available between each even 10 kHz step. Exclusive use of solid state circuitry allows for instantaneous operation, maximum reliability, and minimum power consumption. Modular construction utilizing printed circuit boards provides for ease of troubleshooting and maximum serviceability. The RF-505 Receiver consists of five major modules. They are the Receiver Module, the Synthesizer Module, the Power Supply Module, the Frequency Standard Module, and the Preselector Module.

## 1.3 PURPOSE AND USES

The RF-505 Receiver is designed for continuous operation as a general purpose mf/hf single sideband receiver. It is completely self contained for use in fixed, semi-portable, or mobile installations as a separate unit or as part of a communications system. With suitable adapters the RF-505 Receiver can be rack mounted in a standard 19 inch enclosure, stack mounted with other units, or enclosed in a metal case for desk top installations. Operation is provided from ac primary power sources of 100 to 260 volts, 48 to 1000 Hz, 1 phase, and dc primary power sources of 10 to 40 volts. Total power consumption is 60 watts at maximum audio level.

As a high accuracy receiver and frequency standard source, the RF-505 Receiver has many valuable uses in the laboratory. For communications systems, the RF-505 can easily fill those applications where one or more monitor receivers are required to operate on a single common frequency standard. The frequency standard in this type of application can be either an RF-505 ($\pm 1$ part in $10^6$ with the supplied TCXO standard or $\pm 5$ parts in $10^8$ with the optional high stability oven standard) or a master clock.

Perceptible audio signals can be detected from transmitted single sideband (usb, lsb, or isb) signals, am. or compatible am. signals, and cw signals on any one of 284,000 channels. The channels are spaced in even 100 Hz steps within the operational frequency range of 1.6 MHz and 30.0 MHz. Continuous tuning is provided as a standard feature between each 10 kHz step. Detected audio signals are applied to a front panel speaker, to terminals for two 600 ohm balanced remote output lines, and to a remote speaker terminal. Depending on system application, TTY, digital data, or facsimile equipment can be connected to either or both of the 600 ohm remote audio lines.

## 1.4 TECHNICAL SPECIFICATIONS

Nominal electrical and physical specifications of the RF-505 are listed in table 1.1.

**NOTE**

*Specifications are subject to change without notice.*

## Table 1.1 — RF-505 Receiver Technical Specifications

### FREQUENCY RANGE
1.600 to 29.9999 MHz at full specifications. Usable to 100 kHz with reduced specifications.

### MODES OF OPERATION
Upper sideband (usb), lower sideband (lsb), independent sideband (isb), amplitude modulation (am.) and continuous wave (cw).

### FREQUENCY SELECTION
Digital, 284,000 channels in 100 Hz steps. Continuous tuning selectable between each 10 kHz step.

### FREQUENCY STABILITY
±1 part in $10^6$ with standard TCXO. ±5 parts in $10^8$ with optional high stability oven standard.

### PRIMARY POWER:
AC:
100 to 260 volts, single phase, 48 to 1000 Hz.
DC:
10 to 40 volts.
CONSUMPTION:
60 watts at full audio output level.

### INPUT IMPEDANCE
Nominal 50 ohms resistive.

### SENSITIVITY
SSB:
0.5 microvolts for 10 dB (S+N)/N in a 3 kHz band.
AM:
4.0 microvolts for 10 dB (S+N)/N in a 10 kHz if. band at 30% modulation.

### DYNAMIC RANGE
125 dB

### IMAGE REJECTION
70 dB

### IF. REJECTION
60 dB

### INTERMODULATION
-20 dB nominal with an input of 2 equal tones of 100 millivolts rms each.

### OPPOSITE SIDEBAND SUPPRESSION
Greater than 50 dB at 300 Hz opposite sideband.

### CROSS MODULATION
When receiving desired signal of 100 microvolts rms at J1, an undesired 100 millivolt rms, 30% modulated signal at least 100 kHz away from the received signal shall produce negligible cross-modulation.

### DESENSITIZATION
When receiving desired signal of 100 microvolts rms, 30% modulated an undesired signal of 250 millivolts rms greater than 100 kHz away shall cause no more than a 3 dB decrease in the amplitude of the desired signal.

### EQUIVALENT IF. BANDWIDTH
SSB:
300 Hz to 3.3 kHz at 6 dB.
AM:
Nominal 10 kHz bandwidth at 5 dB.

### AUTOMATIC GAIN CONTROL (AGC)
THRESHOLD:
Nominal 5 microvolt rms signal at J1.
LOOP ERROR:
Less than 12 dB change in audio output for input variations between 5.0 microvolts rms to 500 millivolts rms at J1.
ATTACK TIME:
5 milliseconds nominal.
RELEASE TIME:
1 second nominal.

### AUDIO OUTPUT
MONITOR OUTPUT:
3 watts at 5% distortion into internal speaker (3.2 ohms)
CHANNEL OUTPUTS:
Two separate channels each adjustable to 0 dBrn (5% distortion) into 600 ohms balanced load with 2 microvolts rms input signal.

### ENVIRONMENTAL
TEMPERATURE:
-55°C to +75°C Storage, Operating -28°C to +65°C.
HUMIDITY:
95%
VIBRATION:
Per MIL-STD-167, Type 1.
SHOCK:
Per MIL-STD-202C, Method 205C.

### SIZE
BASIC UNIT (inches):
5-1/4 H x 19 W x 13-7/8 D
BASIC UNIT (cm):
13.272H x 48.260 W x 35.243 D
WITH DESK CASE (inches):
6 H x 19-3/8 W x 15 D
WITH DESK CASE (cm):
15.240 H x 49.213 W x 38.1 D
WITH SLIDES (inches):
5-1/4 H x 19-1/2 W x 13-7/8 D
WITH SLIDES (cm):
13.272 H x 49.53 W x 35.243 D

### WEIGHT
BASIC UNIT (pounds):
29
BASIC UNIT (kg):
13.18
WITH DESK CASE (pounds):
33
WITH DESK CASE (kg):
15.00
WITH SLIDES (pounds):
36
WITH SLIDES (kg)
16.35

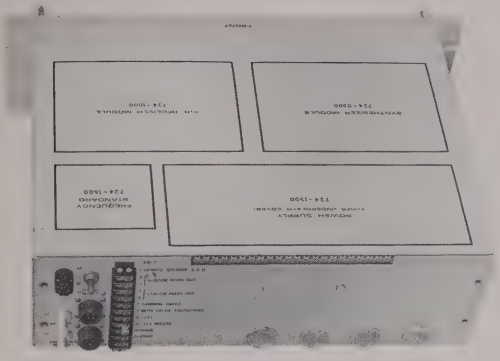


Figure 1.1 — Top and End View of RF-505 Receiver

## 1.5 ACCESSORIES AND SPARES

The following is a list of accessories and spares that are available for use with the RF-505 Receiver. Additional accessories and compatible equipment is listed in RF Communications catalogs or can be obtained from RF Communications Sales Department.

Table 1.2 — RF-505 Receiver Accessories and Spare Parts

| MODEL NO. | DESCRIPTION | RF PART NO. |
|---|---|---|
| RF-506 | Noise Blanker | |
| RF-508 | High Stability Oven | |
| RF-509 | CW Filter (500 Cycle) | 724-1186 |
| RF-511 | Remote Monitor Speaker | |
| RF-512 | Desk Top Case Kit | 724-0044 |
| RF-513 | Stack Mounting Brackets with Slides | 724-0030 |
| RF-514 | Rack Slides (Pair) | 724-0035 |
| RF-515 | Running Spare Parts Kit | 724-0022 |
| RF-516 | Depot Spare Parts Kit | 724-0023 |
| RF-517 | Frequency Standard Divider | |
| RF-518 | Earphones | |
| RF-519 | Comprehensive Spare Parts Kit | 724-0024 |
| RF-520 | Muting Conversion Module | |
| RF-521 | Suitcase Carrying Case | |
| — | *Ancillary Kit | 724-0025 |
| | AC Power Cord Assembly | 724-0029 |
| | DC Power Connector | 724-0040 |
| | Extender | 724-0060 |
| | Test Adapter for 724-0700 Assembly | 724-0708 |
| | Coaxial Test Cable | 724-0032 |
| | Tuning Tool | 724-0026 |
| | Fuse 1A, 3AG | F-0010 |
| | Fuse 2A, 3AG | F-0012 |
| | Fuse 1.5A, 3AG | F-0011 |
| | Fuse 5.0A, 3AG | F-0015 |

*Supplied with the unit

# CHAPTER 2
# INSTALLATION

## 2.1 GENERAL

Chapter two includes information necessary for unpacking and inspection, site selection, antenna and transmission lines, installation, and connections.

## 2.2 UNPACKING AND INSPECTION

No special procedures are required for unpacking. Special care, however, should be exercised to prevent injury to personnel or damage to the equipment. Remove all packing materials and carefully lift the unit from the shipping container. Check contents against the packing list and inspect carefully for physical damage. If any damage is found, save packing material to substantiate claim with transportation agency.

## 2.3 SITE SELECTION

When selecting an installation site, adequate consideration should be given to the following:

a. Best operating conditions (temperature, room, noise level, etc.).

b. Availability of an adequate ground.

c. Accessibility of an antenna system (antennas are discussed in paragraph 2.4).

d. Possibility of interaction from other electronic or power sources.

e. Availability of adequate primary power.

## 2.4 ANTENNAS AND TRANSMISSION LINES

### 2.4.1 GENERAL CONSIDERATIONS

The RF-505 Receiver is designed to operate with any 50 ohm resistive antenna system. The antenna system may be a non-resonant whip or a long wire tuned by an antenna coupler; a resonant dipole antenna cut for a specific operating frequency; or a broadband antenna, such as a log periodic or discone.

For fixed base station operation, either a non-resonant whip or long wire antenna tuned by an antenna coupler is recommended. The long wire antenna is more effective for base station to base station operation, particularly at the lower frequencies. This type of antenna system permits efficient use of all assigned frequencies within the 1.6 to 30.0 MHz frequency range of the RF-505 Receiver.

The half-wave doublet antenna is an efficient, easily constructed, resonant antenna. However, the doublet is efficient for only a narrow band of frequencies within 2-1/2% of the center resonant frequency. Separate doublet antennas must therefore be constructed for each small band of frequencies in use.

Broadband antennas, such as the log periodic or discone, provide an efficient impedance match over their specified operating frequency range. Although this type of antenna eliminates the need of antenna couplers from the system, they are more expensive and more complex in construction.

### 2.4.2 INSTALLATION

To provide maximum receiver sensitivity, the antenna input impedance presented at J1 should be 50 ohms. The use of coaxial cables, such as type RG-58/U or RG-8/U (with suitable adapters) terminated with a BNC connector, prevent feed-line noise pick-up and provide the proper impedance match. When operating with a long wire antenna of random length, an antenna coupler should be used to provide the desired 50 ohm impedance.

For installations where the antenna can be installed in several locations, considerable advantages are offered by selecting the site carefully. Following are some general rules for antenna site selection.

a. Radio signals can be absorbed and reflected by nearby obstructions, such as hills, trees, buildings, and power lines. Avoid these if possible, especially if they are in a direct line with the desired transmitted signal.

b. Some antennas, especially the doublet, are directional. Directional antennas should be oriented for maximum signal gain.

c. Reception is best from the top of a hill, over level ground, or over water.

d. A good earth ground connection will improve performance.

### 2.4.3 DOUBLET ANTENNAS

Doublet antenna kits, such as the RF-334, are available from RF Communications. Three basic types of antennas can be constructed with these kits; the horizontal doublet, the inverted V, and the slant wire (figure 2.1).

All three types are doublet antennas, that is, they each have two legs of equal length with one leg connected to the center conductor of the coaxial cable and the other leg connected to the coax shield. The antenna elements have a combined length of an electrical half wavelength (one-quarter wavelength for each element). The inverted V and slant wire doublets are very useful if the antenna site prohibits the two supports required for the horizontal doublet or if the supports cannot be located so that the doublet is perpendicular to the direction of the desired transmitted signal.

As all of these antennas are directional, the antenna provides better response to received signals from directions perpendicular to the antenna.

Figure 2.1 shows the three types of doublet antennas in typical installations. The length of each element can be determined by the use of one of the following formulas.

Horizontal and Slanted Doublet

Length of Each Element in Feet =

$$\frac{234}{\text{Frequency (MHz)}}$$

Length of Each Element in Meters =

$$\frac{71.3}{\text{Frequency (MHz)}}$$

Inverted V Doublet

Length of Each Element in Feet =

$$\frac{245}{\text{Frequency (MHz)}}$$

Length of Each Element in Meters =

$$\frac{74.5}{\text{Frequency (MHz)}}$$

## 2.5 INSTALLATION

The RF-505 Receiver can be installed in one of three different configurations: (1) rack mounted, (2) stack mounted, or (3) desk top mounted. Refer to figure 2.2.

### 2.5.1 RACK INSTALLATION

To install the RF-505 Receiver in a rack configuration proceed as follows using RF P/N 724-0035.

a. Mount the chassis sections of the slide to each side of the RF-505 unit using four No. 8-32 pan head screws on each section.

b. Mount the cabinet sections of the slide to the equipment rack jamb plate using four 1/4 inch screws on each section.

c. Extend the outer slide member on the cabinet section until the rear locks engage.

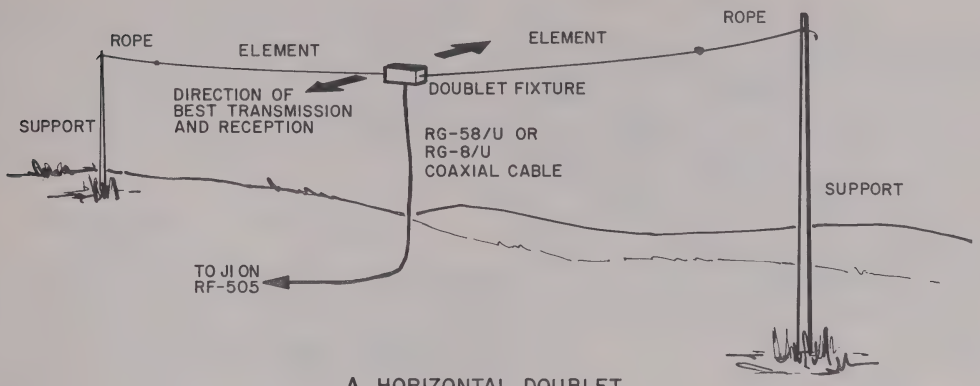
d. Slide the chassis sections into the outer slide members. Push in on the chassis section safety locks and slide the two members together.

e. Release the rear lock and slide the unit into the equipment rack. Secure with front panel mounting hardware.

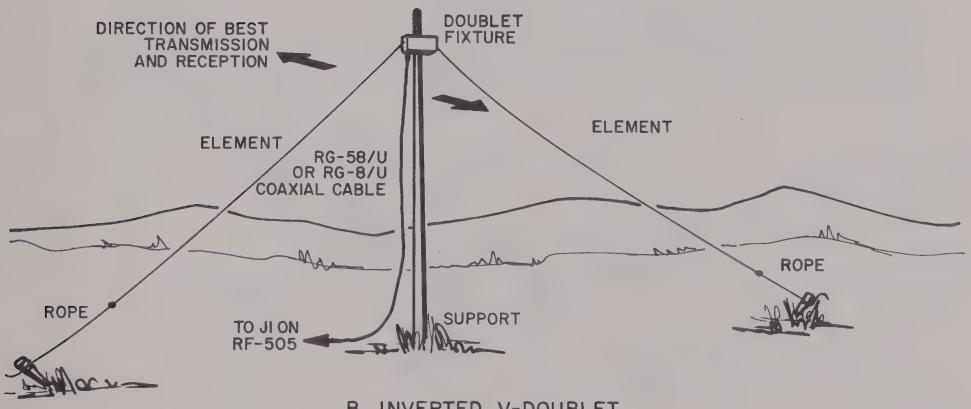
### 2.5.2 STACK INSTALLATION

To install the RF-505 Receiver in a stack installation use adapter brackets 724-0027 (left side) and 724-0028 (right side) and slide unit, 724-0035. Stack installation procedures are the same as those for the rack installation with the following exceptions.

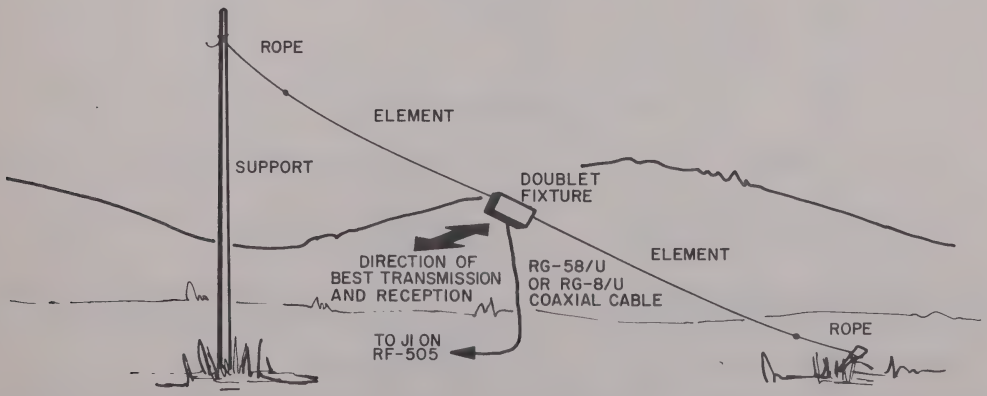
a. The cabinet sections of the slides are mounted on the two stack adapter brackets using eight No. 8-32 pan head screws, lockwashers, and nuts.




A. HORIZONTAL DOUBLET




B. INVERTED V-DOUBLET




C. SLANT WIRE DOUBLET

Figure 2.1 — Typical Doublet Antenna Installation

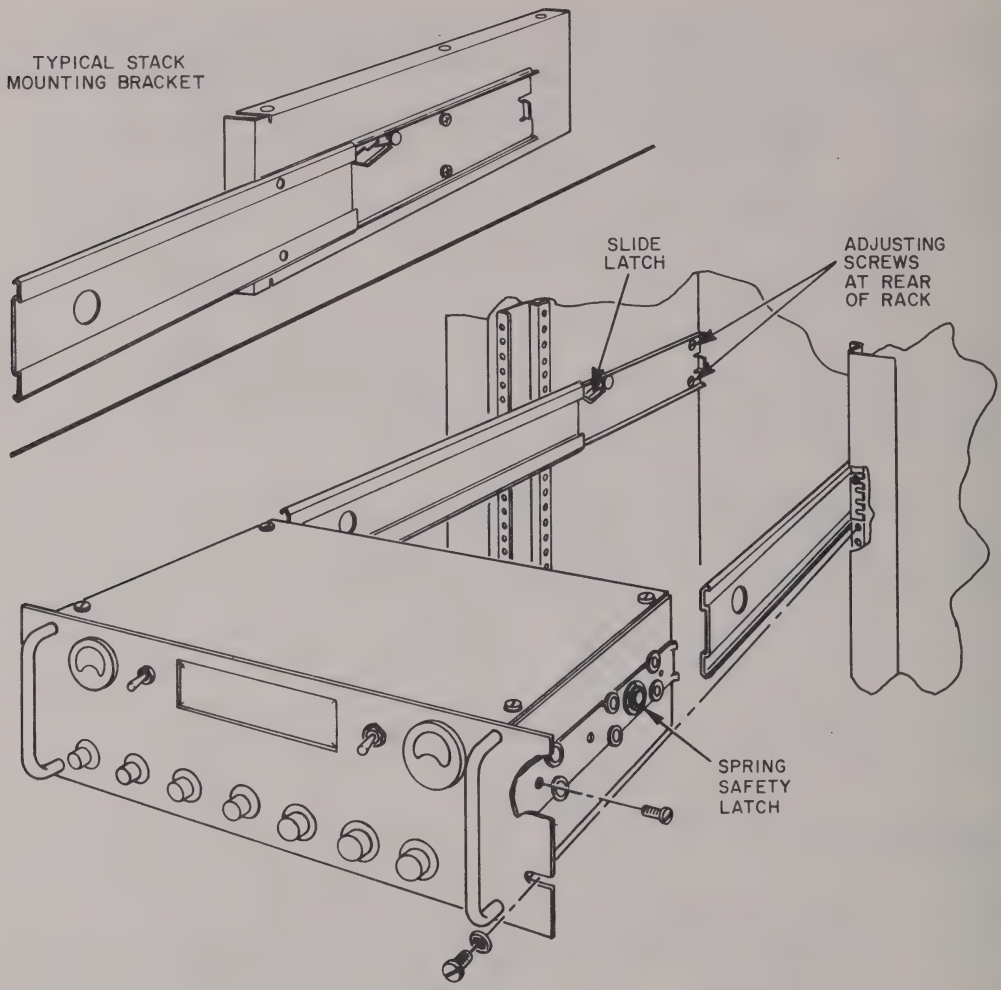



Figure 2.2 — RF-505 Rack Installation

**NOTE**

*The nuts and lockwashers are located on the outside of the stack adapters.*

b. The outer slide members must be extended for access to the two front mounting screws.

2.5.3 DESK TOP INSTALLATION

To install the RF-505 Receiver in the desk top configuration proceed as follows:

a. Slide the RF-505 Receiver into the desk case.

b. Secure the front panel with four No. 10-32 screws with cup washers.

c. Secure the rear panel of the unit to the desk case using four No. 10-32 pan head screws.

## 2.6 CONNECTIONS

Normal connections required by the RF-505 Receiver are: (1) primary power, either ac or dc; (2)

earth ground; and (3) an antenna. However, differences in systems and configurations may require inter-unit connections such as transmit muting, frequency standard input or output, remote speaker, or remote terminal devices. Table 2.1 lists the function of each connector on the RF-505 Receiver. Also included are the mating connector types and cables.

### 2.6.1 PRIMARY POWER CONNECTIONS

The RF-505 Receiver can be operated from either ac power (100 to 260 volts, 48 to 1000 Hz, 1 phase) or dc power (10 to 40 volts). Connect the power cable corresponding to the primary power to J3 for ac or J4 for dc. Set Power Switch S1 to the corresponding position.

**NOTE**

*Observe the polarity of the dc power source when connecting the leads of the dc power cable.*

### 2.6.2 SYSTEM CONNECTIONS

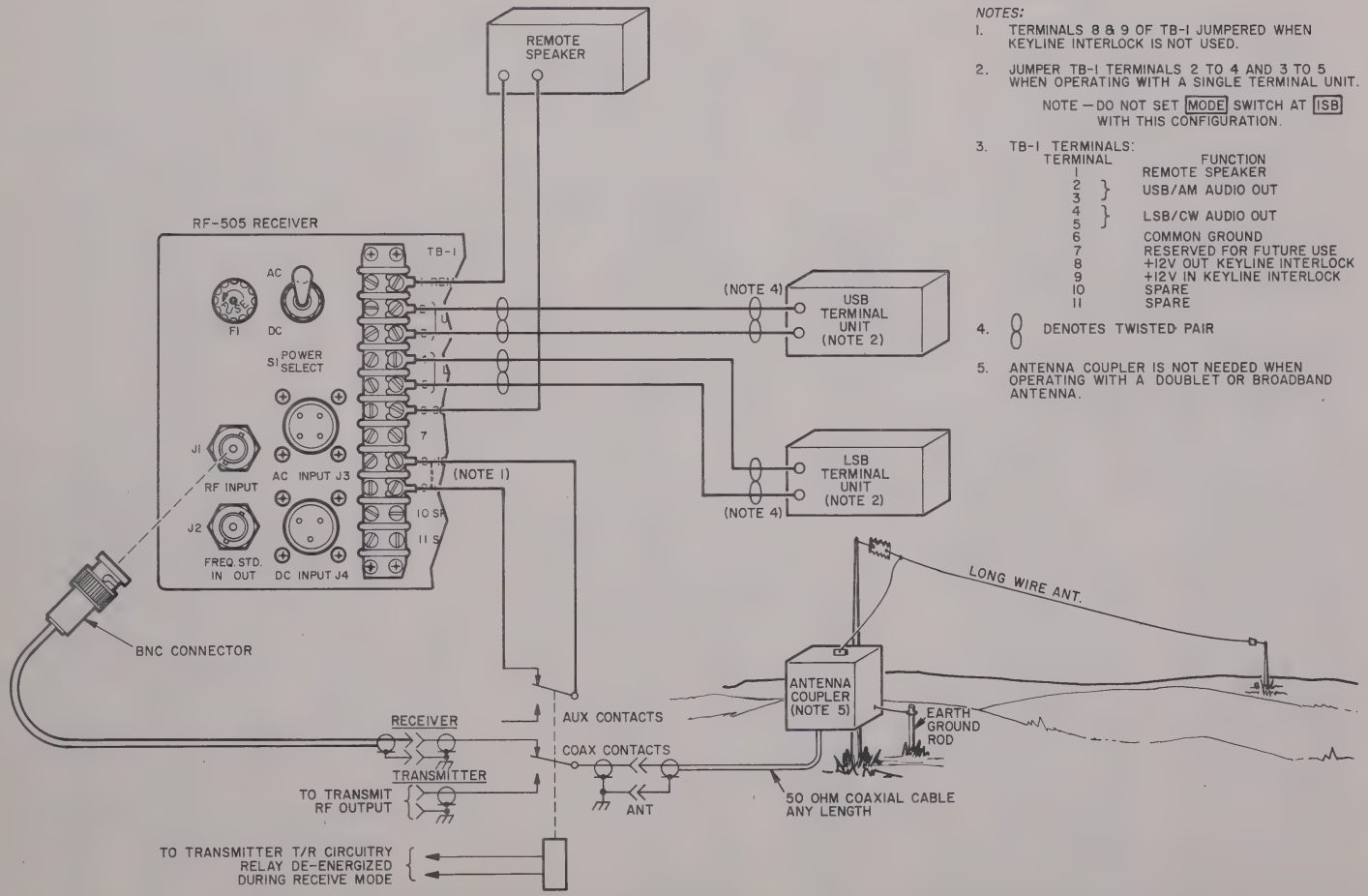
Figure 2.3 shows the RF-505 Receiver connected in a typical communications system. All inter-unit connections are made at TB-1 and J2. Connector J2 provides a frequency standard output signal when S1 on the Frequency Standard Module is at INT OUT. This provides a method of locking all other units of the system to the standard in the RF-505. Operation with an external frequency standard, connected to J2, is provided by setting S1 on the Frequency Standard Module at EXT IN. This locks the RF-505 Receiver to a master clock or to a second RF-505 unit.

**NOTE**

*Only up to three additional RF-505 Receivers can be operated from the internal standard without the use of an additional distribution amplifier.*

Table 2.1 — Rear Panel Connections

| CONNECTOR NO. | FUNCTION | MATING CONNECTOR TYPE | CABLE TYPE |
|---|---|---|---|
| J1 | Antenna Lead Input | BNC (Male) | Coaxial (RG-58/U or RG-8/U) |
| J2 | Frequency Standard Input/Output | BNC (Male) | Coaxial (RG-58/U) |
| J3 | Ac Primary Power | RF P/N 724-0039 | Multiconductor RF P/N W-0000 |
| J4 | Dc Primary Power | RF P/N 724-0040 | Multiconductor |
| TB1 | Accessories Connections: | | |
| | Terminal — Function | | |
| | 1 — Remote Audio Output 3.2 Ohm | Terminal Lugs | Multiconductor |
| | 2, 3 — Balanced 600 Ohms usb/am. Audio Output (Adjustable) | | |
| | 4, 5 — Balanced 600 Ohms lsb/cw Audio Output (Adjustable) | | |
| | 6 — Common Ground | | |
| | 7 — Reserved for future use | | |
| | 8 — +12 vdc output for keyline interlock | | |
| | 9 — +12 vdc return from keyline interlock | | |
| | 10 — Spare | | |
| | 11 — Spare | | |




*NOTES:*

1. TERMINALS 8 & 9 OF TB-1 JUMPERED WHEN KEYLINE INTERLOCK IS NOT USED.
2. JUMPER TB-1 TERMINALS 2 TO 4 AND 3 TO 5 WHEN OPERATING WITH A SINGLE TERMINAL UNIT.
   NOTE — DO NOT SET MODE SWITCH AT ISB WITH THIS CONFIGURATION.
3. TB-1 TERMINALS:

| TERMINAL | FUNCTION |
|---|---|
| 1 | REMOTE SPEAKER |
| 2 } | USB/AM AUDIO OUT |
| 3 } | |
| 4 } | LSB/CW AUDIO OUT |
| 5 } | |
| 6 | COMMON GROUND |
| 7 | RESERVED FOR FUTURE USE |
| 8 | +12V OUT KEYLINE INTERLOCK |
| 9 | +12V IN KEYLINE INTERLOCK |
| 10 | SPARE |
| 11 | SPARE |

4. ⌇ DENOTES TWISTED PAIR
5. ANTENNA COUPLER IS NOT NEEDED WHEN OPERATING WITH A DOUBLET OR BROADBAND ANTENNA.

Figure 2.3 — Typical Antenna and Terminal Unit Connections

# CHAPTER 3
# OPERATION

## 3.1 GENERAL

This chapter includes information and instructions required for proper operation of the RF-505 Receiver. A description of all operating controls, indicators, and connectors is presented first followed by the operation procedures.

## 3.2 OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Table 3.1 lists the operating controls, indicators, and connectors. They are illustrated in figure 3.1.

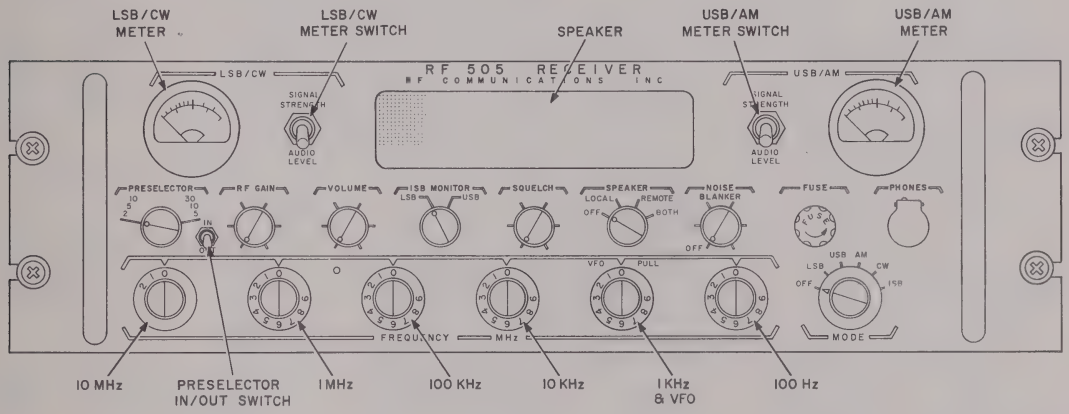



Figure 3.1 — RF-505 Front Panel

Table 3.1 — Operating Controls, Indicators, and Connectors

| CONTROL, INDICATOR OR CONNECTOR | FUNCTION |
|---|---|
| FREQUENCY MHz Switches | a. Selects operating frequency in MHz with six switches; 10 MHz switch, 1 MHz switch, 100 kHz switch, 10 kHz switch, 1 kHz switch, and 100 Hz switch.<br><br>b. The 1 kHz switch is pulled out for continuous tuning between each 10 kHz channels. |
| PRESELECTOR Control | Adjusts tuning of unit to operating frequency when selected. |
| PRESELECTOR In/Out Switch | Selects preselector circuitry into signal path when set at IN. Preselector is bypassed when set at OUT. |
| MODE Switch | Switch Position — Equipment Response |
| | OFF — Disconnect primary power.<br><br>***NOTE***<br>*If the high stability oven standard is installed, the 115 vac oven heater power will be applied to the frequency standard in all positions of MODE switch.* |
| | LSB — a. Applies primary power.<br><br>b. Selects lower sideband receive mode. |
| | USB — a. Applies primary power.<br><br>b. Selects upper sideband receive mode. |
| | AM — a. Applies primary power.<br><br>b. Selects amplitude modulation receive mode for conventional am. signals or compatible am. signals. |
| | CW — a. Applies primary power.<br><br>b. Selects continuous wave receive mode. With optional cw filter installed band width is reduced to 500 Hz for maximum selectivity.<br><br>***NOTE***<br>*If optional cw filter is not installed the receiver will be inoperative in this mode. However, cw signals may be received in either the lsb, usb or isb positions.* |
| | ISB — a. Applies primary power.<br><br>b. Selects independent sideband receive mode for dual reception of both the upper and lower sidebands. |
| RF GAIN Control | Adjust attenuation of received signals level. Counter clockwise rotation decreases input level to receiver module. |
| NOISE BLANKER Control (Optional) | Provides reduced sensitivity to random noise spikes. Clockwise rotation increases blanking action. OFF position de-activates noise blanker circuitry. |
| SPEAKER Switch | Switch Position — Equipment Response |
| | OFF — Audio signals removed from front panel and remote speaker output terminal at TB1.<br><br>LOCAL — Audio signals applied to internal speaker only.<br><br>REMOTE — Audio signals applied to remote speaker output terminal at TB1 only. |

Table 3.1 — Operating Controls, Indicators, and Connectors (Cont.)

| CONTROL, INDICATOR OR CONNECTOR | FUNCTION |
|---|---|
| SPEAKER Switch (Cont.) | Switch Position: BOTH — Equipment Response: Audio signals applied to both speaker and remote speaker output terminal at TB1. |
| SQUELCH Control | Adjust squelch threshold level. Clockwise rotation decreases the level required by the received signal to break squelch silence. If the control is advanced fully clockwise, the receiver is always unsquelched. |
| ISB MONITOR Switch | When ISB mode is selected by MODE switch the ISB MONITOR switch provides the following functions:<br>Switch Position: LSB — Equipment Response: Audio signals detected from the lower sideband are applied to SPEAKER switch.<br>Switch Position: USB — Equipment Response: Audio signals detected from the upper sideband are applied to SPEAKER switch. |
| VOLUME Control | Adjust level of received audio signal at front panel speaker, PHONES jack, and the remote speaker terminal at TB1. During isb mode adjust audio output level of channel selected by ISB MONITOR switch. |
| FUSE | Ac primary power fuse F1. |
| PHONES Jack | For connecting headphones to monitor received audio signals. |

| CONTROL, INDICATOR OR CONNECTOR | FUNCTION |
|---|---|
| LSB/CW Switch | Switch Position: SIGNAL STRENGTH — Equipment Response: LSB/CW meter indicates the level of the lsb or cw received signal in "S" units.<br>Switch Position: AUDIO LEVEL — Equipment Response: LSB/CW meter indicates level of detected audio in dBm into a 600 ohm load. |
| LSB/CW Meter | Indicates level of either the lsb or cw signal in signal ("S") strength or dBm into a 600 ohm line. |
| Speaker | Provides monitoring of detected audio signal selected by the SPEAKER switch (positions LOCAL and BOTH). |
| USB/AM Switch | Switch Position: SIGNAL STRENGTH — Equipment Response: USB/AM meter indicates the level of either the usb or am. received signal in "S" units.<br>Switch Position: AUDIO LEVEL — Equipment Response: USB/AM meter indicates the level of either the usb or am. detected audio in dBm into a 600 ohm load. |
| USB/AM Meter | Indicates level of either the usb or am. signal in signal strength ("S") units or dBm into a 600 ohm load. |

## 3.3 OPERATING INSTRUCTIONS

### 3.3.1 USB, LSB, AM., AND ISB MODES

a. Set the following switches and controls at the positions listed.

| Switch or Control | Position |
|---|---|
| MODE Switch | At desired mode. |
| LSB/CW and USB/AM. switches | At SIGNAL STRENGTH |
| FREQUENCY MHz switches | To operating frequency. |
| NOISE BLANKER control (Optional) | Fully counterclockwise. |
| SQUELCH control | Fully clockwise. |
| SPEAKER switch | At LOCAL. |
| RF GAIN control | Fully clockwise |
| PRESELECTOR select switch | At IN. |

b. Adjust VOLUME control for desired listening level.

c. Tune PRESELECTOR control to peak the signal on the receiver S meter corresponding to the selected mode.

d. If optional noise blanker is installed, adjust NOISE BLANKER control clockwise to reduce pulse noise interference.

e. If strong interference is present, adjust RF GAIN control counterclockwise to minimize.

f. For isb mode, set ISB MONITOR switch first at LSB and then at USB to check for signals on each channel.

g. If received signal is garbled, pull out on 1 kHz FREQUENCY MHz switch and adjust for best signal.

h. Adjust SQUELCH control counterclockwise until desired signal is squelched OFF. Readjust clockwise stopping just as the desired signal is again present.

i. For remote audio monitoring, set SPEAKER switch at either REMOTE or BOTH.

### 3.3.2 CW MODE

**NOTE**

*If unit does not have optional cw filter installed, cw signals can be received on either the usb, lsb, or isb modes.*

a. Perform steps a through d of 3.3.1 above.

b. Set MODE switch at USB.

c. Set FREQUENCY MHz switch at exact channel frequency then rotate either the 100 Hz or 1 kHz switch for the most desirable beat tone.

d. Set MODE switch at CW.

**NOTE**

*The cw filter band pass is centered in the usb sideband.*

**NOTE**

*Some transmitted cw signals are offset from the channel frequency. Therefore the FREQUENCY MHz switches must be set at 1000 Hz below the channel frequency.*

# CHAPTER 4
# THEORY OF OPERATION

## 4.1 GENERAL

This discussion of the theory of operation of the RF-505 is separated into four parts. A brief description is presented first followed by a block diagram discussion of the RF-505 Receiver. Block diagram discussions of the Receiver and Synthesizer Modules covers the theory to the level of the individual assemblies. For more detailed theory of the Power Supply Module, Frequency Standard Module, and of the various assemblies in the Receiver and Synthesizer Modules refer to the appropriate chapters in this manual.

## 4.2 DESCRIPTION

The RF-505 Receiver is a double conversion superheterodyne receiver for operation in the medium and high frequency range of 1.6 to 30.0 MHz. Modes of operation are; lsb, usb, am., cw, and isb. The isb mode is for simultaneous reception and monitoring of both sideband signals on a single channel frequency. Frequency stability is $\pm 1$ part in $10^6$ over the operating frequency range. Front panel FREQUENCY MHz switches allow the operator to digitally select the operating frequency to within the 100 Hz digit. Continuous tuning (vfo) between each 10 kHz steps is provided by pulling out on the 1 kHz control. Basically the RF-505 Receiver consists of a main frame chassis with Receiver Module (724-1000), Synthesizer Module (724-0500), Power Supply Module (724-1500), Frequency Standard Module (724-1600) and Preselector Assembly (724-1650).

## 4.3 RF-505 RECEIVER BLOCK DIAGRAM THEORY

**NOTE**

*Refer to Figure 4.1 during the following discussion.*

Rf signals, received by the antenna, are applied to RF INPUT connector J1. The received rf signals are then coupled to the Rf Gain Control Assembly (724-0162) in the Preselector. Controlled by the position of RF GAIN control, the Rf Gain Control Assembly attenuates the input levels of the received rf signal while maintaining a constant 50 ohm input impedance to the receiver module. This allows the operator to attenuate high level, on frequency, signals to prevent overdriving without reducing the full 125 dB dynamic range of the receiver.

From the output of the Rf Gain Control Assembly the rf signal is applied to PRESELECTOR In/Out switch. When set at OUT the output of the Rf Gain Control Assembly is applied directly to the Receiver Module. The IN position couples the received rf signal through the Preselector circuitry to the input of the Receiver Module. The function of the Preselector is to improve cross modulation and desensitization performance of the receiver by rejecting off frequency signals.

In the Receiver Module the received rf signal is progressively mixed with three injection signals supplied by the Synthesizer Module. The first injection signal, local oscillator number 1, is variable between 156.0000 MHz and 185.9999 MHz. It is controlled by the FREQUENCY MHz switches to provide a 156.0 MHz difference frequency (first if. signal) when mixed with the received signal. The 156.0 MHz signal is filtered, amplified and mixed with the second injection signal, local oscillator number 2 (156.5 MHz). The difference, 500 kHz, is selected as the second if. signal. The second if. signal is amplified, coupled through selectable sideband filters, and applied to a usb product detector, to a lsb product detector and to an am. envelope detector. In each product detector the second if. ssb signal (nominal 500 kHz) is mixed with a 500 kHz injection signal. The 500 kHz injection signal is the 1 MHz output from the Synthesizer Module (local oscillator number 3) divided by two in the Receiver Module. The mixing results in the audio intelligence being extracted from the if. sideband signal. During am. operation the audio signal is detected by the am. envelope detector circuitry. The audio signal from the appropriate detector is amplified and applied to a squelch gate diode and to a remote audio amplifier.

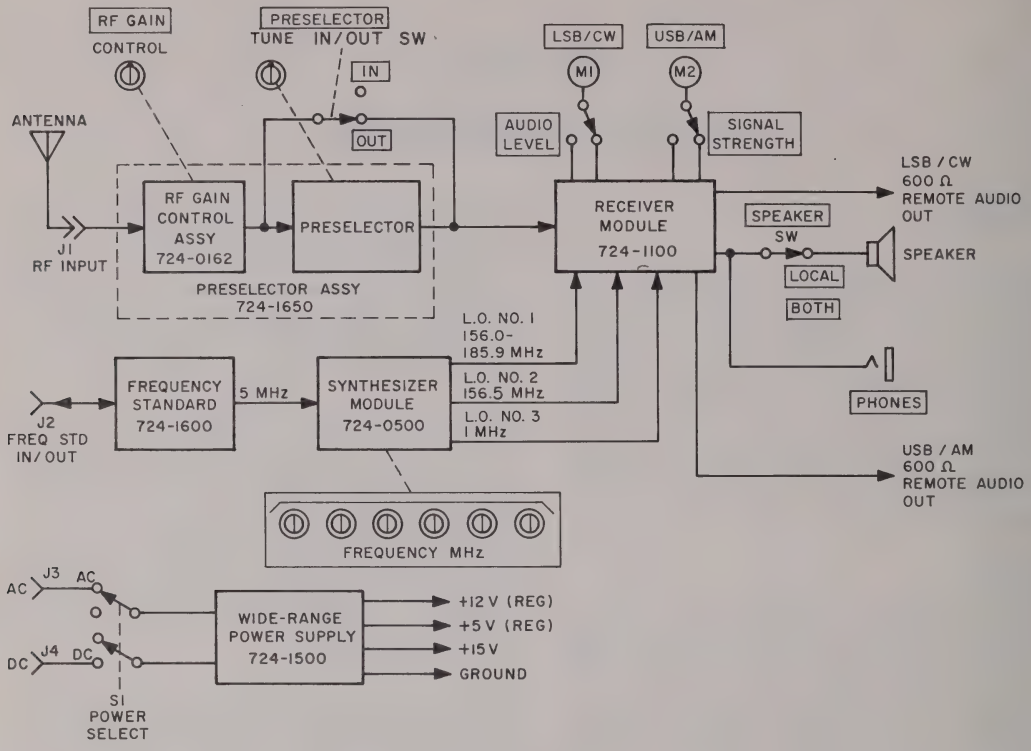



Figure 4.1 — RF-505 Receiver Block Diagram

The squelch gate diode blocks all received signals that are below a predetermined level, adjusted by the SQUELCH control, from the speaker amplifier. From the output of the speaker amplifier the signal is applied to the front panel PHONES jack and through the BOTH and SPEAKER contacts of SPEAKER switch to the front panel speaker.

The output of the remote audio amplifier is coupled to rear panel remote audio output terminals and to the audio level meter circuitry. The audio level meter circuitry provides a dc voltage proportional to the audio level. This voltage is coupled through the AUDIO LEVEL contacts of USB/AM and LSB/CW Meter switches to the respective front panel meters.

Frequency Standard Module 724-1600 supplies the 5 MHz frequency standard signal to the Synthesizer Module. The reference signal is selected on the module from either a temperature compensated crystal oscillator (TCXO) installed on the module, or from an external 5 MHz source connected to the rear panel of the unit. The external source can be either a master clock or a second RF-505 unit. The accuracy and stability rating of the TCXO is ±1 part in $10^6$. An optional high stability standard is available by special order with an accuracy and stability of ±5 parts in $10^8$.

Power Supply Module 724-1500 provides all operating voltages from primary power sources of either ac (100 to 260 volts, 48 to 1000 Hz, single phase) or dc (10 to 40 volts). Output voltages are +12 vdc regulated, +5 vdc regulated, and +15 vdc. The Power Supply Module uses a proportional control configuration to automatically provide a constant output with input voltage variations.

## 4.4 RECEIVER MODULE

Receiver Module 724-1000 contains the circuitry for converting the received rf signals to perceptible audio signals. To accomplish this the Receiver Module consists of the following six printed circuit assemblies and an interconnecting mother board.

a. Front End Assembly 724-1100.

b. Usb/Am. Filter Assembly 724-1150.

c. Lsb/Cw Filter Assembly 724-1175.

d. Two each Detector/Agc Assemblies 724-1200.

e. Speaker Driver Assembly 724-1250.

Referring to figure 4.2, the input rf signal from the Preselector Assembly is applied to Front End Assembly 724-1100 for mixing with the first and second local oscillator injection signals. The input rf signal is first coupled through a low pass filter, which attenuates all received rf signals above 35 MHz, to the input of an up-converter and mixer. The first local oscillator injection signal, from the Synthesizer Module, is also applied to the up-converter and mixer and is always 156.0 MHz higher in frequency than the frequency of the desired received rf signal. The difference between these two signals is selected by a filter, amplified, and applied to a second mixer as the 156.0 MHz first if. signal. In the second mixer, the second local oscillator injection signal (156.5 MHz) from the Synthesizer Module is mixed with the first if. signal. Again the difference is selected (500 kHz) as the second if. signal. The second if. signal is then amplified and applied to the input terminal of Usb/Am. Filter Assembly 724-1150 and to the input terminal of Lsb/Cw Filter Assembly 724-1175.

When selected by the MODE switch, each filter assembly, filters out the unwanted signals and couples the desired sideband if. signal to the corresponding Detector/Agc Assembly. During isb operation (MODE switch at ISB) both the usb and lsb filters on their respective assemblies are selected. This allows the audio signals on both sidebands of a carrier frequency to be detected as two separate audio channels.

The single sideband if. signal at the input of each Detector/Agc Assembly is coupled to a product detector (for ssb and cw signals) and to an am./agc amplifier. The output of the am./agc amplifier is then applied to the am. envelope detector and to the agc detector. The product detector and am. envelope detector are utilized to recover the transmitted audio signal from the second if. signal. Depending on the operating mode of the unit, the output of the appropriate audio detector is selected and amplified by a preamplifier mode switch. From the preamplifier mode switch the audio is then applied to the MODE switch and to the input of the line amplifier.

The MODE switch selects the audio output and agc signal output from the Detector/Agc Assembly corresponding to the operating mode as inputs to the Speaker Driver and Squelch Gate Assembly. The squelch circuitry compares the agc signal level, indicating received signal level, with a predetermined level controlled by the position of the SQUELCH control. When the received signal agc level is proportional to the SQUELCH control level the squelch gate diode is forward biased coupling the audio signal to the audio power amplifier. The audio output from the audio power amplifier is applied to the SPEAKER switch and to the front panel PHONES jack. SPEAKER switch applies the audio signal to the front panel speaker, LOCAL and BOTH positions, and to the rear panel remote speaker terminal, REMOTE and BOTH positions.

The received audio signal from the preamplifier mode switch in the Detector/Agc Assembly is also amplified by the line amplifier to provide a balanced 600 ohm remote audio output. A portion of the line amplifier output is applied to an audio level meter amplifier where it is amplified and then rectified by the audio level rectified circuitry. The output of the rectifier is a dc voltage proportional to the level of the audio signal. This dc voltage is coupled to the front panel meters, to indicate received audio level, through the AUDIO LEVEL contacts of the Meter switches.

From the agc detector the agc signal is also routed to the if. amplifier in the corresponding filter assemblies, to the dc amplifier, to the MODE switch, and to the "S" meter amplifier.

The agc signal at the if. amplifier is used to adjust the gain of each channel, individually. Dc amplifier provides a delayed agc signal, through an OR gate configuration with the other channel, to adjust the overall gain of the receiver at the Front End Assembly. "S" meter amplifier provides a dc voltage through the SIGNAL STRENGTH contacts of each Meter switch to the front panel meter. This dc voltage indicates the level of the received rf signal.

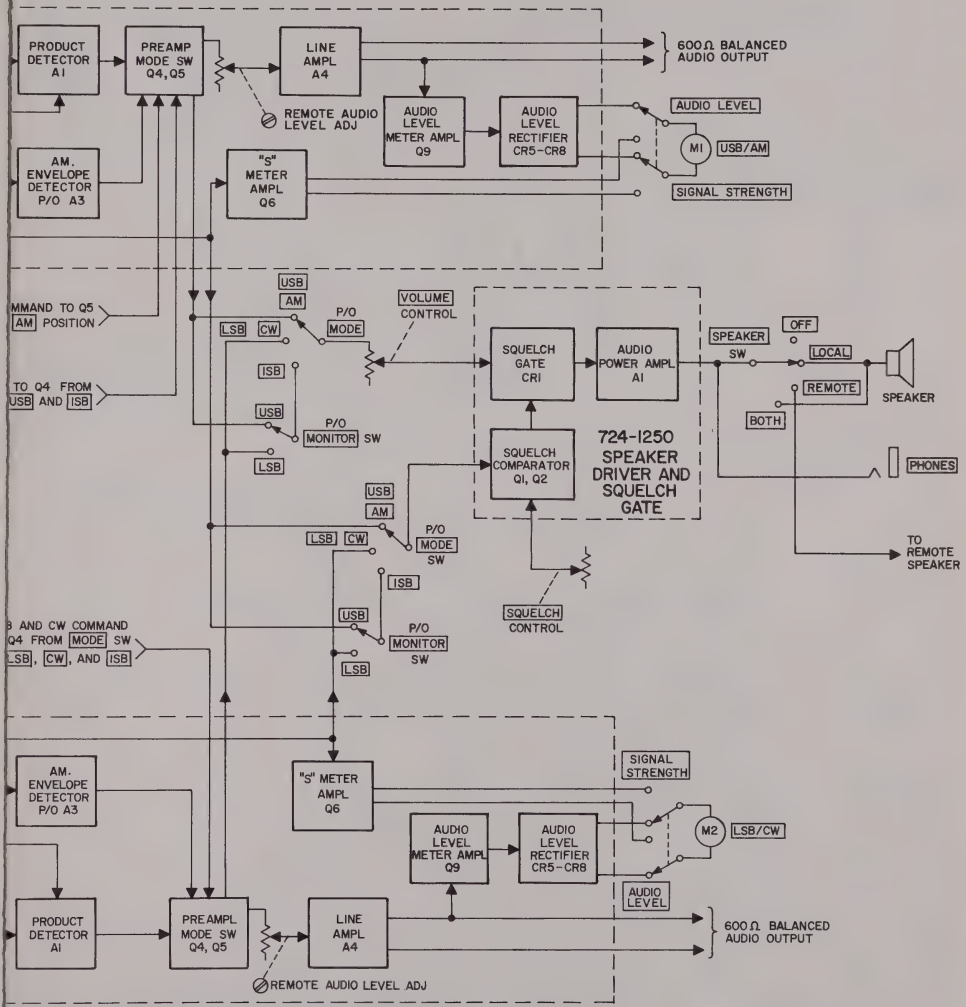



Figure 4.2 — RF-505 Receiver Module Block Diagram

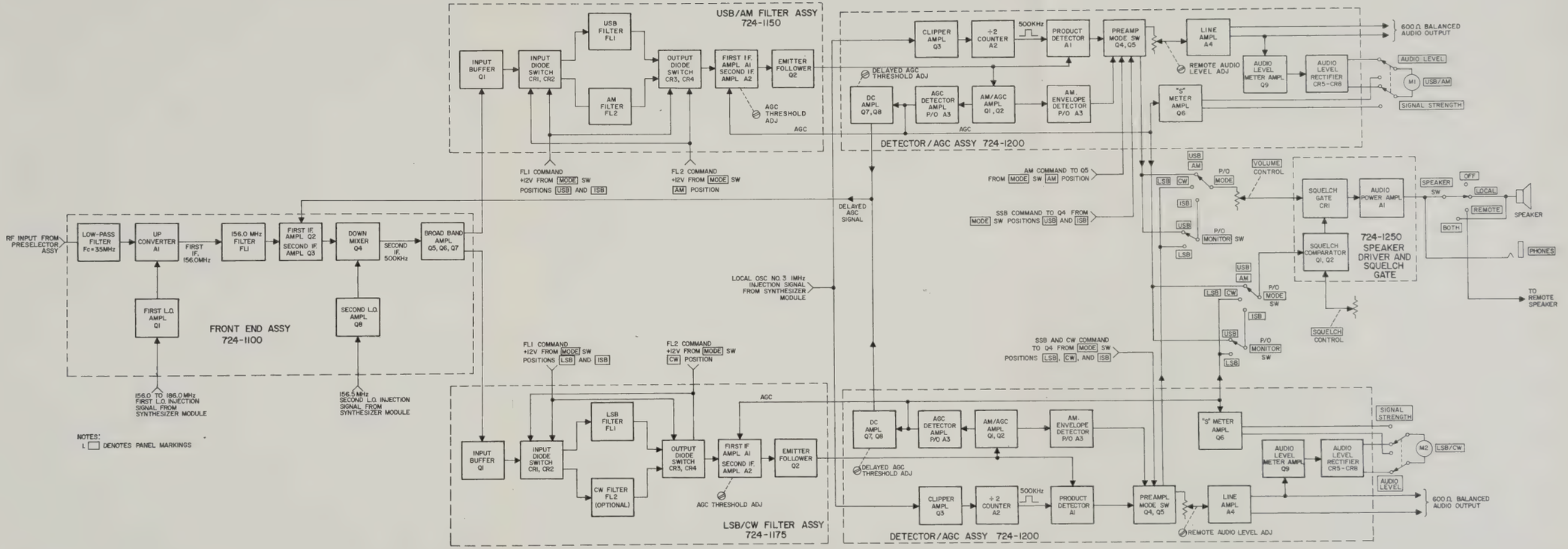

USB/AM FILTER ASSY 724-1150
INPUT BUFFER Q1
INPUT DIODE SWITCH CR1, CR2
USB FILTER FL1
AM FILTER FL2
OUTPUT DIODE SWITCH CR3, CR4
FIRST I.F. AMPL. A1 SECOND I.F. AMPL. A2
EMITTER FOLLOWER Q2
AGC THRESHOLD ADJ
AGC
FL1 COMMAND +12V FROM MODE SW POSITIONS USB AND ISB
FL2 COMMAND +12V FROM MODE SW AM POSITION
DETECTOR/AGC ASSY 724-1200
CLIPPER AMPL Q3
÷2 COUNTER A2
500KHz
PRODUCT DETECTOR A1
PREAMP MODE SW Q4, Q5
LINE AMPL A4
600Ω BALANCED AUDIO OUTPUT
DELAYED AGC THRESHOLD ADJ
REMOTE AUDIO LEVEL ADJ
AUDIO LEVEL METER AMPL Q9
AUDIO LEVEL RECTIFIER CR5-CR8
AUDIO LEVEL
M1
USB/AM
SIGNAL STRENGTH
DC AMPL Q7, Q8
AGC DETECTOR AMPL P/O A3
AM/AGC AMPL Q1, Q2
AM. ENVELOPE DETECTOR P/O A3
"S" METER AMPL Q6
AM COMMAND TO Q5 FROM MODE SW AM POSITION
SSB COMMAND TO Q4 FROM MODE SW POSITIONS USB AND ISB
VOLUME CONTROL
P/O MODE
P/O MONITOR SW
SQUELCH GATE CR1
AUDIO POWER AMPL A1
SQUELCH COMPARATOR Q1, Q2
724-1250 SPEAKER DRIVER AND SQUELCH GATE
SPEAKER SW
OFF
LOCAL
REMOTE
BOTH
SPEAKER
PHONES
TO REMOTE SPEAKER
SQUELCH CONTROL
SSB AND CW COMMAND TO Q4 FROM MODE SW POSITIONS LSB, CW, AND ISB
DELAYED AGC SIGNAL
LOCAL OSC NO. 3 1MHz INJECTION SIGNAL FROM SYNTHESIZER MODULE
RF INPUT FROM PRESELECTOR ASSY
LOW-PASS FILTER Fc=35MHz
UP CONVERTER A1
FIRST IF. 156.0MHz
156.0 MHz FILTER FL1
FIRST IF. AMPL. Q2 SECOND IF. AMPL. Q3
DOWN MIXER Q4
SECOND IF. 500KHz
BROAD BAND AMPL Q5, Q6, Q7
FRONT END ASSY 724-1100
FIRST L.O. AMPL Q1
SECOND L.O. AMPL Q8
156.0 TO 186.0MHz FIRST L.O. INJECTION SIGNAL FROM SYNTHESIZER MODULE
156.5MHz SECOND L.O. INJECTION SIGNAL FROM SYNTHESIZER MODULE
NOTES:
1. DENOTES PANEL MARKINGS
FL1 COMMAND +12V FROM MODE SW POSITIONS LSB AND ISB
FL2 COMMAND +12V FROM MODE SW CW POSITION
LSB/CW FILTER ASSY 724-1175
LSB FILTER FL1
CW FILTER FL2 (OPTIONAL)
M2
LSB/CW

Figure 4.2 — RF-505 Receiver Module Block Diagram

## 4.5 SYNTHESIZER MODULE

### 4.5.1 GENERAL

Synthesizer Module 724-0500 provides the three injection signals for frequency conversion required by the unit. These signals are synthesized from voltage controlled oscillators that are phase locked to a 5.000000 MHz standard signal or generated by dividing the 5 MHz standard signal, by decade counters, down to the required frequency. The output signals are 1.0 MHz, 156.5 MHz, and a variable frequency between 156.0000 and 185.9999 MHz, depending on the operating frequency of the unit. The 5 MHz input standard signal is supplied to the Synthesizer Module by a frequency standard source either located within the unit (Frequency Standard Module) or externally (Master Clock or a second unit such as another RF-505 Receiver).

The Synthesizer Module consists of eight printed circuit board assemblies with an interconnecting mother board. These assemblies are mounted in a modular aluminum chassis. The assemblies are:

a. Spectrum Generator Assembly 724-0750.

b. Second Local Oscillator Assembly 724-0800.

c. HF Voltage Controlled Oscillator Assembly (HF VCO) 724-0550.

d. HF Divider Assembly 724-0600.

e. 14 MHz Upmixer and Variable Frequency Oscillator Assembly (14 MHz Upmixer and VFO) 724-0900.

f. Translator Assembly 724-0850.

g. VHF Voltage Controlled Oscillator Assembly (VHF VCO) 724-0650.

h. VHF Divider Assembly 724-0700.

### 4.5.2 BLOCK DIAGRAM THEORY

**NOTE**

*Refer to figure 4.3 during the following discussion.*

Basically the Synthesizer Module consists of three major circuits, each one providing a specific output signal or signals. They are the spectrum generator (Spectrum Generator Assembly 724-0750), the second local oscillator (Second Local Oscillator Assembly 724-0800), and the first local oscillator circuitry.

An external frequency standard signal of 5 MHz is applied to the Spectrum Generator Assembly where it is amplified and applied to a pulse generator and digital counters. The pulse generator produces a narrow pulse output signal that contains the desired harmonics. Bandpass filters are utilized to select the desired 20 and 15 MHz signals. Digital counters progressively divide the 5 MHz signal to 1 MHz, 500 kHz, 25 kHz, and 1 kHz. The 1 MHz signal is applied, after filtering, as an output injection signal and to a band-pass filter where the twelfth harmonic is extracted as an output signal. The 500 kHz, 25 kHz, and 1 kHz signals are supplied as output signals to the second local oscillator circuitry. The second local oscillator circuitry provides the fixed 156.5 MHz injection signal to the Receiver Module. This signal is generated by a voltage controlled crystal oscillator (VCXO) connected in a phase lock loop configuration. Two input signals, a 160 MHz signal from the Translator Assembly and a 500 kHz signal from the Spectrum Generator Assembly, are used in the phase lock loop as reference standards.

The first local oscillator is further divided into three sub-circuits; loop number 1, translator, and loop number 2. Loop number 1 contains the HF VCO and the HF Divider assemblies. The 14 MHz Upmixer and VFO assembly and Translator Assembly make up the translator circuitry section of the first local oscillator. Loop number 2 consists of the VHF VCO assembly, VHF Divider Assembly, and the down-mixer portion of the Translator Assembly. Loop number 1 provides the 100 Hz, 1 kHz, and 10 kHz digits of the first local oscillator injection signal. The translator section converts the output of loop number 1, 1.0000 to 1.0999 MHz, up to 146.0000 to 146.0999 MHz through two stages of mixing. VFO tuning of the unit is also provided at this stage. The 100 kHz, 1 MHz, and 10 MHz portion of the first local oscillator injection signal is supplied by loop number 2. This provides an output signal that will vary from 156.0000 MHz to 185.9999 MHz in 100 Hz steps. The exact frequency depends on the position of the front panel FREQUENCY MHz control switches.

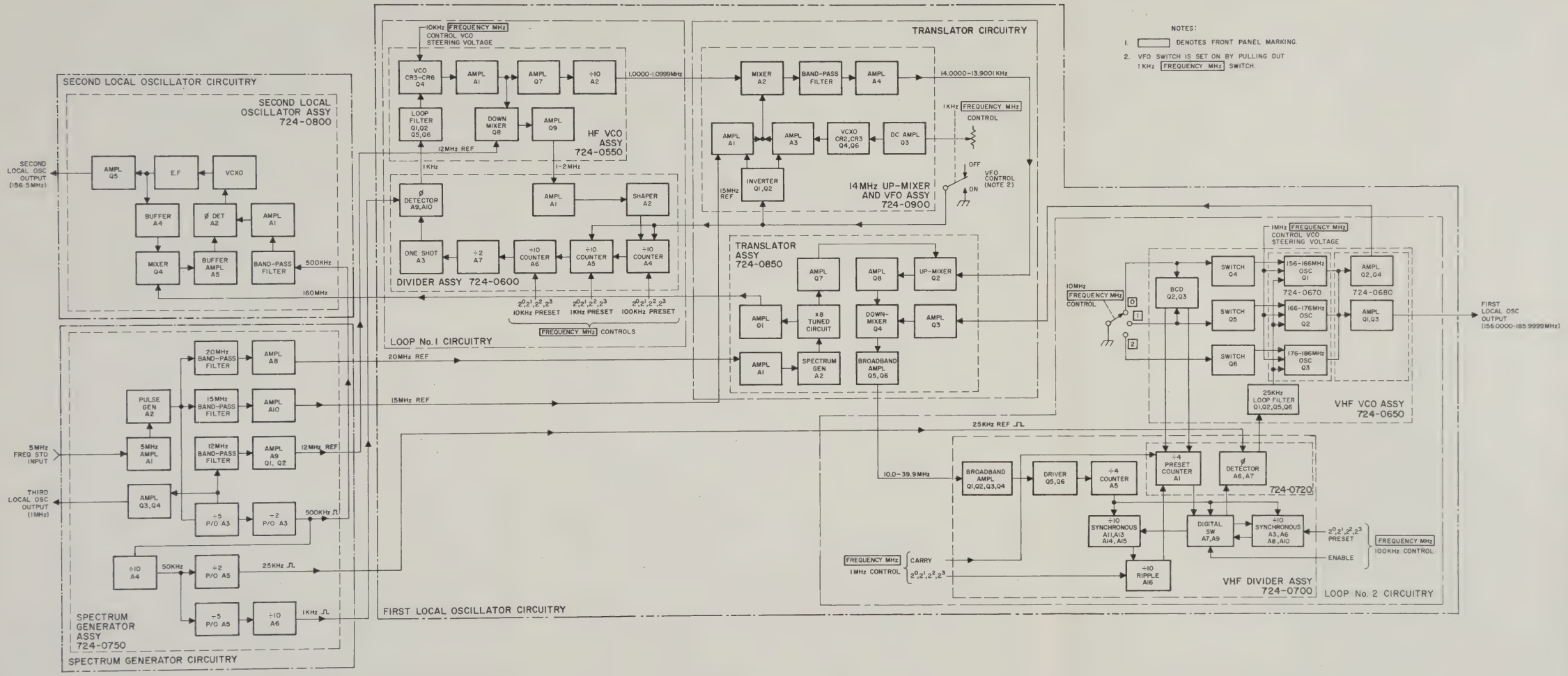



Figure 4.3 – RF-505 Synthesizer Module Block Diagram

## 4.5 SYNTHESIZER MODULE

### 4.5.1 GENERAL

Synthesizer Module 724-0500 provides the three injection signals for frequency conversion required by the unit. These signals are synthesized from voltage controlled oscillators that are phase locked to a 5.000000 MHz standard signal or generated by dividing the 5 MHz standard signal, by decade counters, down to the required frequency. The output signals are 1.0 MHz, 156.5 MHz, and a variable frequency between 156.0000 and 185.9999 MHz, depending on the operating frequency of the unit. The 5 MHz input standard signal is supplied to the Synthesizer Module by a frequency standard source either located within the unit (Frequency Standard Module) or externally (Master Clock or a second unit such as another RF-505 Receiver).

The Synthesizer Module consists of eight printed circuit board assemblies with an interconnecting mother board. These assemblies are mounted in a modular aluminum chassis. The assemblies are:

a. Spectrum Generator Assembly 724-0750.

b. Second Local Oscillator Assembly 724-0800.

c. HF Voltage Controlled Oscillator Assembly (HF VCO) 724-0550.

d. HF Divider Assembly 724-0600.

e. 14 MHz Upmixer and Variable Frequency Oscillator Assembly (14 MHz Upmixer and VFO) 724-0900.

f. Translator Assembly 724-0850.

g. VHF Voltage Controlled Oscillator Assembly (VHF VCO) 724-0650.

h. VHF Divider Assembly 724-0700.

### 4.5.2 BLOCK DIAGRAM THEORY

**NOTE**

*Refer to figure 4.3 during the following discussion.*

Basically the Synthesizer Module consists of three major circuits, each one providing a specific output signal or signals. They are the spectrum generator (Spectrum Generator Assembly 724-0750), the second local oscillator (Second Local Oscillator Assembly 724-0800), and the first local oscillator circuitry.

An external frequency standard signal of 5 MHz is applied to the Spectrum Generator Assembly where it is amplified and applied to a pulse generator and digital counters. The pulse generator produces a narrow pulse output signal that contains the desired harmonics. Bandpass filters are utilized to select the desired 20 and 15 MHz signals. Digital counters progressively divide the 5 MHz signal to 1 MHz, 500 kHz, 25 kHz, and 1 kHz. The 1 MHz signal is applied, after filtering, as an output injection signal and to a band-pass filter where the twelfth harmonic is extracted as an output signal. The 500 kHz, 25 kHz, and 1 kHz signals are supplied as output signals to the second local oscillator circuitry. The second local oscillator circuitry provides the fixed 156.5 MHz injection signal to the Receiver Module. This signal is generated by a voltage controlled crystal oscillator (VCXO) connected in a phase lock loop configuration. Two input signals, a 160 MHz signal from the Translator Assembly and a 500 kHz signal from the Spectrum Generator Assembly, are used in the phase lock loop as reference standards.

The first local oscillator is further divided into three sub-circuits; loop number 1, translator, and loop number 2. Loop number 1 contains the HF VCO and the HF Divider assemblies. The 14 MHz Upmixer and VFO assembly and Translator Assembly make up the translator circuitry section of the first local oscillator. Loop number 2 consists of the VHF VCO assembly, VHF Divider Assembly, and the down-mixer portion of the Translator Assembly. Loop number 1 provides the 100 Hz, 1 kHz, and 10 kHz digits of the first local oscillator injection signal. The translator section converts the output of loop number 1, 1.0000 to 1.0999 MHz, up to 146.0000 to 146.0999 MHz through two stages of mixing. VFO tuning of the unit is also provided at this stage. The 100 kHz, 1 MHz, and 10 MHz portion of the first local oscillator injection signal is supplied by loop number 2. This provides an output signal that will vary from 156.0000 MHz to 185.9999 MHz in 100 Hz steps. The exact frequency depends on the position of the front panel FREQUENCY MHz control switches.

To further illustrate the operation of the first local oscillator circuitry consider an operating frequency of 12.3456 MHz as set by the front panel FREQUENCY MHz switches. The output of the VHF VCO Assembly, local oscillator number 1, should be 168.3456 MHz since the first local oscillator is always 156.0000 MHz higher in frequency than the operating frequency.

In the VHF VCO Assembly one of three voltage controlled oscillators (vco) is selected by the 10 MHz FREQUENCY MHz control. Vco number one for operating frequencies up to 9.9999 MHz, vco number two for operating frequencies between 10.0000 and 19.9999 MHz, and vco number three for frequencies between 20.0000 and 29.9999 MHz. A coarse tuning voltage to the selected oscillator is provided by a resistive voltage divider chain on the 1 MHz Switch. Fine tuning of the vco provides the 1 MHz, 100 kHz, 10 kHz, 1 kHz and 100 Hz information and is accomplished by comparing the output of the selected vco, approximately 168.3456 MHz with a 146.0456 MHz signal in the Translator Assembly. The 146.0456 signal contains the 10 kHz, 1 kHz, and 100 Hz digit information. Therefore the difference between these two signals will reflect this information as an error if the vhf vco is off frequency. This signal, approximately 22.3000 MHz, is applied to the VHF Divider Assembly where it is divided down by preset counters. The counters, controlled by the 1 MHz and 100 kHz controls, provides a division that will result in a quotient of 25 kHz if the vhf vco is exactly on frequency. Any other frequency than the expected 25 kHz signal reflects the 1 MHz, 100 kHz, digital information plus the 10 kHz, 1 kHz, and 100 Hz information carried over by the input signal to the dividers. This signal is then applied to a phase detector where it is compared with a 25 kHz reference signal. If the input signal is not 25 kHz the phase detector will lock, either high or low and provide a steering voltage to the 25 kHz loop filter in the VHF VCO Assembly. The steering voltage will shift the frequency of the vhf vco in the proper direction until the output is on frequency. At that time the phase detector will unlock and provide a 25 kHz output signal. The 25 kHz signal is filtered into a dc voltage that stabilizes the vhf vco on frequency.

The 146.0456 MHz signal in the Translator Assembly with which the output of the vhf vco is mixed, is derived in the following way.

At the HF VCO Assembly a preset voltage, controlled by a resistor voltage divider network on the 10 kHz control set at position 4, coarse tunes the hf vco to approximately 10.456 MHz. Fine tuning of the hf vco for the exact 10 kHz, 1 kHz, and 100 Hz digit is accomplished in the same fashion as the vhf vco. To control the output of the hf vco to the exact required frequency (fine tuning), the output signal of the hf vco is mixed with a 12 MHz reference signal. The difference, 1.544 MHz, is then divided by preset counters controlled by the 10 kHz, 1 kHz, and 100 Hz controls. These counters are preset to provide an output of 1 kHz if the hf vco is exactly on frequency. If the hf vco is off frequency the output of the counters will reflect the error. The output signal of the divider is then compared to a fixed reference 1 kHz signal in a phase detector. When the hf vco is on frequency the output of the phase detector is 1 kHz. If the hf vco is off frequency then the phase detector will lock, depending on the direction of the error, either high or low. This lock signal, a dc voltage, will steer the hf vco in the proper direction until it is on frequency. At that time the phase detector output will unlock and provide a 1 kHz signal and the hf vco will stabilize on frequency.

The output of the hf vco is divided by ten in the HF VCO Assembly to provide an output of 1.0456 MHz. This signal is applied to the 14 MHz Upmixer and VFO Assembly. In this assembly the 1.0456 MHz signal is mixed with a reference signal of 15 MHz to provide an output of 13.9544 MHz.

During VFO operation, the fixed 15 MHz signal is replaced with a variable 14.9001 to 15.0000 MHz signal. This variable frequency signal is controlled by rotating the 1 kHz FREQUENCY MHz control.

The 13.9544 MHz signal is then applied to the Translator Assembly and mixed with a 160 MHz referenced signal. The difference, 146.0456 MHz, is selected as the signal for mixing with the output of the VHF VCO Assembly output signal, local oscillator number 1.

# CHAPTER 5
# MAINTENANCE

## 5.1 GENERAL

This chapter contains procedures for routine maintenance and overall performance test. Also included are a fault analysis table, to aid the repair man in isolating a trouble to the defective module or subassembly, and module removal procedures.

## 5.2 PREVENTATIVE MAINTENANCE

Periodically, depending upon usage the covers should be removed from the case and the receiver inspected for loose or damaged components. Inspect all wiring for kinks, frayed, loose, or burned wires. Check cable connections, making sure that all connectors are free from corrosion and are properly secured. Using a hand controlled dry air jet (not more than 15 psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.

## 5.3 PERFORMANCE TEST

5.3.1 GENERAL

To determine the condition of the RF-505, perform the over-all performance tests outlined in the following subparagraphs. Comparing the data from these tests to the tolerance listed and to previous recorded data may aid in determining a specific problem or a deterioration in performance.

5.3.2 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Audio vtvm – Ballentine, Model 314A

b. Oscilloscope – Tektronix, Model 453

c. Rf signal generator – HP, Model 606

d. Variac – capable of 0-260 vac, 60 Hz, 3 amps

e. Coaxial cable – 5 feet with male BNC Connectors

f. Phone plug (RF P/N P-0013) with shielded wire

g. DC power supply – capable of 0-44 vdc at 4 amps

h. AC power cord assembly – RF P/N 724-0029 (supplied)

i. DC power connector – RF P/N 724-0040 connector

j. VOM – Simpson Model 260

k. Two each 560 ohm, 2 watt resistors

l. 3 ohm, 5 watt resistors

5.3.3 PRELIMINARY

a. Using the coaxial cable, connect the rf signal generator to RF-505 rear panel connector J1.

b. Connect the ac power cable to connector J3 and to a 117 vac, 60 Hz, 1 phase power source. Set rear panel POWER SELECT switch at AC.

c. Connect phone plug to RF-505 PHONES jack and connect audio vtvm to phone plug leads.

d. At RF-505 front panel, set the following switches and controls to the positions listed.

| Switch or Control | Position |
|---|---|
| FREQUENCY MHz switches | 01.6000 MHz |
| SQUELCH control | Fully clockwise |
| MODE switch | LSB |
| LSB/CW Meter switch | SIGNAL STRENGTH |
| USB/AM Meter switch | SIGNAL STRENGTH |
| SPEAKER switch | LOCAL |
| PRESELECTOR switch | OUT |
| VOLUME control | Midrange |
| RF GAIN control | Fully clockwise |

e. At rf signal generator, set controls for a cw output signal of 1.6 MHz at 100 microvolts. Fine tune the frequency for an audio signal (beat tone).

## 5.3.4 RECEIVER SENSITIVITY AND PRESELECTOR TEST

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Refer to paragraph 5.3.3 and perform steps a through e. | |
| 2. | Audio vtvm at PHONES jack for steps 2 through 8. | At rf signal generator adjust frequency for a peak audio signal on audio vtvm. | Peak indication. |
| 3. | | At rf signal generator reduce rf output to zero. Adjust VOLUME control on RF-505 for a 10 mV indication. | 10 mVrms. |
| 4. | | At rf signal generator adjust rf output to 1.0 microvolts. | Minimum 10 dB increase over level in step 3. |
| 5. | | At rf signal generator increase rf output to 20 microvolts. At RF-505 set PRESELECTOR switch at IN and adjust PRESELECTOR control for a peak indication. | |
| 6. | | At rf signal generator reduce rf output to zero. At RF-505 adjust VOLUME control for a 10 mV indication. | 10 mVrms. |
| 7. | | At rf signal generator increase rf output to 1.0 microvolts. | Minimum 10 dB increase over level in step 6. |
| 8. | | At RF-505 set MODE switch at USB and repeat steps 1 through 6. | |
| 9. | | At rf signal generator set frequency to 30.0 MHz. At RF-505 set FREQUENCY MHz switches at 29.9999 and repeat steps 1 through 8. | |

## 5.3.5 SQUELCH TEST

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Refer to paragraph 5.3.3 and perform steps a through e. | |
| 2. | Audio vtvm at PHONES jack for steps 2 through 6. | At rf signal generator adjust frequency for a peak audio indication. | Peak indication. |
| 3. | | At RF-505 adjust SQUELCH counterclockwise until the audio signal is muted. Slowly adjust the SQUELCH control back and forth until the point is found where the audio signal just unmutes. | |
| 4. | | At rf signal generator reduce the rf output level until the audio just mutes off. Record this rf level. | |
| 5. | | At rf signal generator increase the rf output level until the audio just unmutes. Record this level. | The difference between the level of step 4 and 5 must be less than 10 dB. |
| 6. | | At RF-505 set MODE switch at LSB and repeat steps 2 through 5. | |

## 5.3.6 AGC LOOP TEST

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Refer to paragraph 5.3.3 and perform steps a through e. | |
| 2. | | At rf signal generator set output level at 5 microvolts and tune frequency for a peak indication. | LSB/CW meter just begins to indicate up-scale. |
| 3. | Audio vtvm at PHONES jack. | At RF-505 adjust VOLUME control for a 10 mV indication. | 10 mVrms. |
| 4. | Audio vtvm at PHONES jack. | At rf signal generator set rf output level at 500 mV. | Vtvm indicates less than 12 dB change. LSB/CW meter indicates up-scale. |
| 5. | | At RF-505 set MODE switch at USB and repeat steps 2 through 4 while observing the USB/AM meter. | |

## 5.3.7 AUDIO OUTPUT TEST

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | At RF-505 rear panel connect a 3 ohm 5 watt resistor at TB1, terminal 1 to terminal 6. Connect a 560 ohm, 2 watt resistor at TB1, terminal 2 to 3. Connect a second 560 ohm resistor at TB1, terminals 4 to 5. | |
| 2. | | Refer to paragraph 5.3.3 and perform steps a through e. | |
| 3. | | At RF-505 set MODE switch at AM, SPEAKER switch to REMOTE. | |
| 4. | Front panel speaker. | At rf signal generator set rf output at 100 microvolts, 30% modulation at 1000 Hz. Fine tune frequency for peak audio signal at RF-505. | Peak indication. |
| 5. | Oscilloscope probe at TB1 terminal 1, ground at terminal 6. | At RF-505 adjust VOLUME control for a 9 volt peak-to-peak waveform. | No clipping of waveform shall be present. |
| 6. | Same as step 5. | At RF-505 set SPEAKER switch at BOTH. | Waveform shall be between 4.4 and 5.1 volts peak-to-peak. |
| 7. | Front panel USB/AM meter. | At RF-505 adjust RF GAIN control counterclockwise while observing USB/AM meter. | Indication shall smoothly decrease by at least 4 "S" units with control fully counterclockwise. |
| 8. | | At RF-505 set MODE switch at LSB, SPEAKER switch at LOCAL. | |
| 9. | Audio vtvm across resistor at TB1, terminals 4 and 5. | At rf signal generator set rf output to cw, fine tune frequency for peak audio signal. Set rf output level at 100 microvolts. | Between 0.7 and 0.93 Vrms. |
| 10. | Front panel LSB/CW meter. | At RF-505 set LSB/CW Meter switch at AUDIO LEVEL. | Meter should indicate 0 dBm ±3 dBm. Observe that only LSB/CW meter is illuminated. |
| 11. | Same as step 9. | At RF-505 set MODE switch at ISB. | Same as step 9. Observe that both meters are illuminated. |
| 12. | Front panel speaker. | At RF-505 set ISB MONITOR switch at LSB. | Audio present at speaker. |
| 13. | | At RF-505 set MODE switch at USB. | |

## 5.3.7 AUDIO OUTPUT TEST (Cont.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 14. | Audio vtvm across resistor at TB1, terminals 2 and 3. | At rf signal generator adjust frequency for peak audio signal. Set rf output level at 100 microvolts. | Between 0.7 and 0.93 Vrms. |
| 15. | Front panel USB/AM meter. | At RF-505 set USB/AM Meter switch at AUDIO LEVEL. | Meter should indicate 0 dBm ±3 dBm. Observe that only USB/AM meter is illuminated. |
| 16. | Same as step 14. | At RF-505 set MODE switch at ISB. | Same as step 14. |
| 17. | Front panel speaker. | At RF-505 set ISB MONITOR switch at USB. | Audio signal present at speaker. |
| 18. | Disconnect test equipment. | Disconnect resistors from TB1. | |

## 5.3.8 POWER SUPPLY TEST

**CAUTION**

*Do not perform this test if High Stability Oven Standard (724-1601) is installed.*

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Refer to paragraph 5.3.3 and perform steps a through e. | |
| 2. | | At RF-505 set MODE switch at OFF. Disconnect ac power cord from primary source and connect to variac. | |
| 3. | | At variac adjust for 117 Vrms output. | |
| 4. | Front panel speaker and audio vtvm at PHONES jack. | At RF-505 set MODE switch at LSB. | Observe audio signal indication on vtvm. |
| 5. | Same as step 4. | At variac vary output voltage from 90 to 260 volts. | No discernible change in audio level. |
| 6. | | At RF-505 set MODE switch at OFF. Disconnect ac power cord and connect dc power connector. Connect pin 1 of dc power connector to positive terminal of dc power supply, pin 2 to negative terminal of dc power supply. Adjust dc power supply for 10 vdc output. Set POWER SELECT switch S1 at DC. | |
| 7. | Same as step 4. | At RF-505 set MODE switch at LSB. | Same as step 4. |
| 8. | Same as step 4. | At dc power supply vary output voltage from 10 to 40 vdc. | No discernible change in audio level. |
| 9. | Disconnect test equipment. | At RF-505 set MODE switch at OFF and disconnect dc power cable. Set POWER SELECT switch S1 at AC. | |

## 5.4 FAULT ANALYSIS TABLE

A fault analysis table is presented below as an aid in sectionalizing or localizing source of trouble in the RF-505.

Table 5.1 – Fault Analysis

| SYMPTOM | POSSIBLE TROUBLE | CHECKS AND CORRECTIVE MEASURES |
|---|---|---|
| Receiver inoperative, meters not illuminated. | a. Primary power fuse F1 open for ac operation or F2 open for dc operation. | a. Replace fuse. |
| | b. Power Supply Module fuse F1 open. | b. Replace defective fuse. |
| | c. POWER SELECT switch S1 at improper position. | c. Set S1 to position corresponding to primary power source. |
| | d. Primary power source improper. | d. Make voltage measurement to verify. Notify responsible personnel. |
| | e. Power cord defective or not connected. | e. Make continuity check of power cable. Repair or replace cable. |
| | f. Power Supply Module defective. | f. Refer to chapter 9. Repair or replace Power Supply Module. |
| No audio or background noise at speaker or PHONES jack. Meters indicate both rf and audio signals present. Audio signals present at TB1 terminals, 2 and 3, 4 and 5. No audio at TB1 terminal 1. | a. Fuse F1 on Speaker Driver Assembly open. | a. Replace fuse. |
| | b. Speaker Driver Assembly defective. | b. Refer to chapter 7. Repair or replace defective assembly. |
| | c. SPEAKER switch set at OFF or defective. | c. Set SPEAKER switch at BOTH. Make continuity checks and replace faulty component or repair wiring. |
| | d. SQUELCH control set fully counterclockwise or defective. | d. Adjust SQUELCH control. Make continuity check and replace faulty component. |
| No audio or background noise at speaker in all modes. Meters do not indicate rf signal but illuminate when selected. | a. Mute jumper or receiver keyline open at TB1 terminals 8 and 9. | a. Make continuity check. Repair open cable or replace jumper. |
| | b. Frequency Standard Module defective or Mode switch S1F1 set at improper position. | b. Check for proper position of Mode switch. Refer to chapter 11 and repair or replace Frequency Standard Module. |
| | c. Synthesizer Module defective. | c. Refer to chapter 8, repair or replace defective module. |
| | d. Frequency Standard and Synthesizer Module interconnecting coaxial cables open. | d. Make continuity check. Repair or replace defective cables. |
| | e. Front End Assembly in Receiver Module defective. | e. Refer to chapter 7. Repair or replace defective assembly. |
| Am. mode normal, all other modes inoperative. | a. Third local oscillator injection signal absent at receiver module. | a. Make continuity check of coaxial cable. Repair or replace. |
| | b. Synthesizer Module defective. | b. Refer to chapter 8, repair or replace Synthesizer Module. |

Table 5.1 — Fault Analysis (Cont.)

| SYMPTOM | POSSIBLE TROUBLE | CHECKS AND CORRECTIVE MEASURES |
|---|---|---|
| Usb and/or am. modes inoperative, lsb and cw modes normal. | a. Usb/Am. Filter Assembly defective. | a. Refer to chapter 7, repair or replace defective assembly. |
| | b. Usb/Am. Detector/Agc Assembly defective. | b. Refer to chapter 7, repair or replace defective assembly. |
| | c. MODE switch or associated wiring defective. | c. Make continuity checks. Repair or replace defective component. |
| Lsb and/or cw modes inoperative, usb and am. modes normal. | a. Lsb/Cw Filter Assembly defective. | a. Refer to chapter 7, repair or replace defective assembly. |
| | b. Lsb/Cw Detector/Agc Assembly defective. | b. Refer to chapter 7, repair or replace defective assembly. |
| | c. MODE switch or associated wiring defective. | c. Refer to chapter 6, make continuity checks. Repair or replace defective components. |
| Usb or am. audio signals absent at TB1 terminals 2 and 3. Speaker normal. | Usb/Am. Detector/Agc Assembly defective. | Refer to chapter 7, repair or replace defective assembly. |
| Lsb or cw audio signals absent at TB1, terminals 4 and 5. Speaker normal. | Lsb/Cw Detector/Agc Assembly defective. | Refer to chapter 7, repair or replace defective assembly. |
| Received signals are weak in all modes. | a. RF GAIN control improperly adjusted or defective. | a. Adjust control for maximum signal strength. Make continuity check and replace defective component. |
| | b. Agc action improper. | b. Refer to chapter 7, and make agc checks and adjustments. |
| | c. Front End Assembly defective. | c. Refer to chapter 7, repair or replace defective assembly. |
| | d. Synthesizer Module injection signals improper. | d. Refer to chapter 8, repair or replace defective module. |
| Large received signals are distorted in all modes. | a. RF GAIN control improperly adjusted. | a. Rotate RF GAIN control counterclockwise for best signal response. |
| | b. Front End Assembly defective. | b. Refer to chapter 7, make agc check and repair or replace defective assembly. |
| | c. Improper agc adjustment in either Detector/Agc Assembly. | c. Refer to chapter 7, make agc checks and adjustments. |
| Large received signals are distorted in lsb and cw modes only. | Improper agc action in either Lsb/Cw Filter Assembly or Lsb/Cw Detector/ Agc Assembly. | Refer to chapter 7, make agc check. Repair or replace defective assembly. |
| Large received signals are distorted in usb and am. modes only. | Improper agc action in either Usb/Am. Filter Assembly or Usb/Am. Detector/ Agc Assembly. | Refer to chapter 7, make agc checks. Repair or replace defective assembly. |

## 5.5 MODULES REMOVAL

To remove the modules from the main chassis proceed as follows:

### 5.5.1 RECEIVER AND SYNTHESIZER MODULES

a. Loosen the four captive screws located at each corner of the module.

b. Slide module toward rear of unit to disconnect multi-pin connector.

c. Lift up on module for access to coaxial cable connectors and disconnect.

d. Lift module up and out of unit.

### 5.5.2 POWER SUPPLY MODULE

**NOTE**

*In most cases it is unnecessary to completely remove the power supply for servicing as all components are accessible with the module mounted in the unit.*

a. Remove top cover from module.

b. At printed circuit board remove screws securing it to module. Rotate the printed circuit board upward for access to the two mounting screws.

c. Loosen the two mounting screws under the printed circuit board and the two captive screws at the end of the module adjacent to connector J1501.

d. Disconnect connector J1501.

e. Remove the three screws at the back panel, and lift the module up and out of the unit.

### 5.5.3 FREQUENCY STANDARD MODULE

a. Tag and unsolder the three wires at C1, C2, and C3.

b. Disconnect the coaxial cable connectors from J1601 and J1602.

c. Loosen the four mounting screws and lift the module up and out of the unit.

### 5.5.4 PRESELECTOR MODULE

**NOTE**

*Refer to paragraph 5.5.1 and remove the Synthesizer Module before proceeding with the following procedures.*

a. At the rear of the Preselector Module disconnect coaxial connectors P1651 and P1653 and the main harness connector P1652.

b. Remove the two screws and lockwashers securing the 724-0232 Synthesizer Post Regulator Assembly to the Preselector Module. Rotate the assembly away from the module for access to the shield mounting screw.

c. Remove the two screws and lockwashers securing the Preselector Module shield. Remove the shield.

d. At the front panel of the RF-505 rotate the PRESELECTOR Tune control for access to the two lock screws securing the shaft of C1 to the planetary drive coupler. Loosen the screws.

e. At the front panel of the RF-505 remove the knobs from the PRESELECTOR Tune control and Select switch and from the FREQUENCY MHz 10 MHz and 1 MHz switches. Remove the hex nuts from each of the above controls.

f. Slide the Preselector Module back until the shafts clear the mounting holes then lift the module up and out of the unit.

## 5.6 MODULE REPLACEMENT

Reverse the removal procedures for the installation of the modules in the RF-505.

**NOTE**

*After installing the Preselector Module perform step a through d below.*

a. If the shaft of C1 does not align with the planetary coupler loosen the three mounting screws securing C1 to the Preselector chassis. Align the shafts and then retighten the three screws.

b. Tighten the lock screws on the planetary coupler.

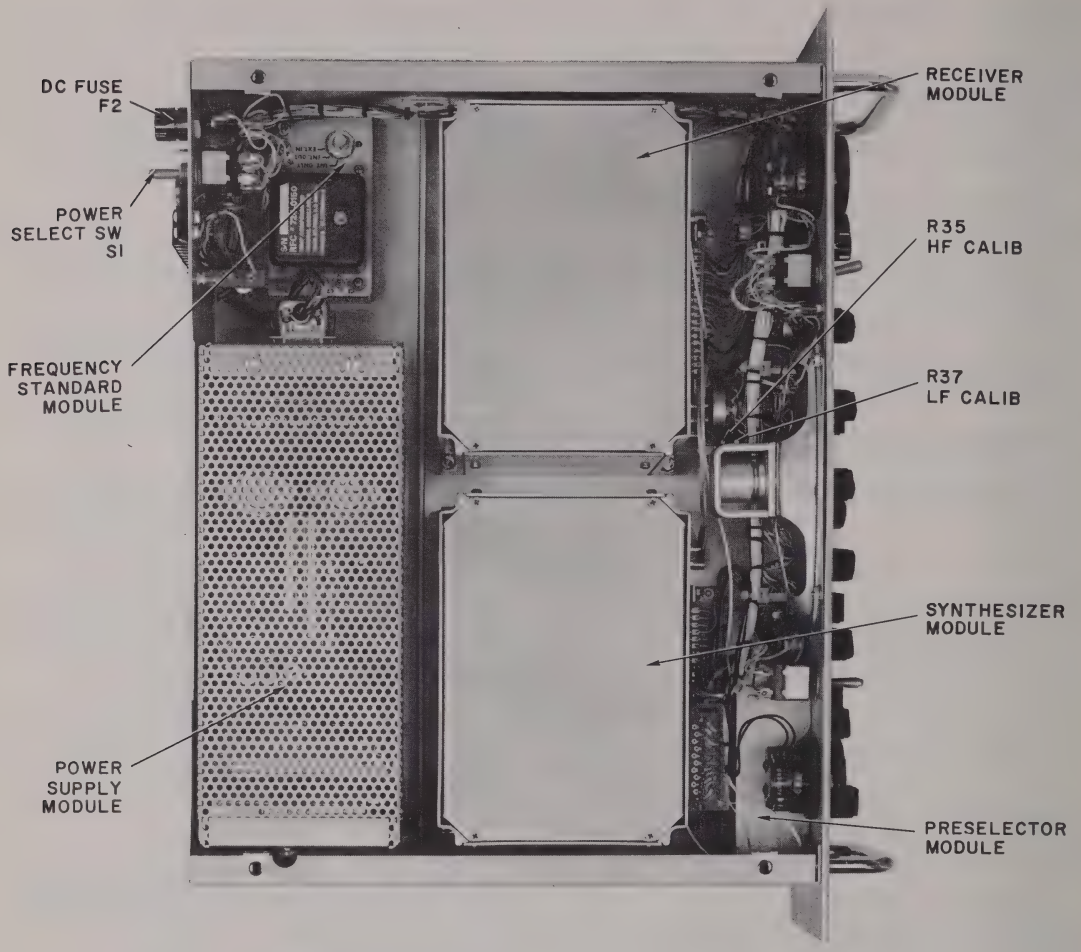



Figure 5.1 – RF-505 Top View (Cover Removed)

c. At the front panel rotate PRESELECTOR Tune control to the counterclockwise stop of capacitor C1.

d. Loosen the lock screws on the PRESELECTOR Tune indicator (skirt) and align the pointer with the 2 on the front panel. Retighten the set screw.

## 5.7 PRINTED CIRCUIT ASSEMBLIES

### 5.7.1 REMOVAL

To remove the printed circuit assemblies from the Receiver and Synthesizer Modules proceed as follows:

a. Lift up on the two plastic latch tabs to unlock the assembly.

b. Rotate the tabs toward the outside of the modules to disengage the assembly from the module connector.

c. Release the two tabs and slide the assembly up until it is out of the module.

### 5.7.2 EXTENDER

To use the assembly extender (RF P/N 724-0060) proceed as follows:

a. Remove the assembly from the module using the procedures of paragraph 5.7.1.

**NOTE**

*The extender is keyed to prevent connecting it into the module in the wrong direction.*

b. Slide the extender into the assembly connector on the module.

**CAUTION**

*The component side of the assembly must be located on the same side as the extender connector to prevent reversal of the interconnecting circuitry.*

c. Connect the assembly to the extender, refer to figure 5.2.

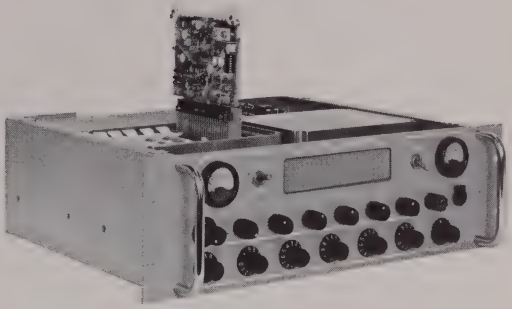


Figure 5.2 — RF-505 Shown With an Assembly Extended for Testing

5.7.3 ASSEMBLY INSTALLATION

To install the assembly into the module proceed as follows:

**NOTE**

*Each assembly connector is keyed to prevent accidental connection to a wrong module connector, refer to the figure on the module top cover.*

a. Slide the assembly into the module.

b. Push down on the assembly until the two connectors are engaged.

# CHAPTER 6

# MAIN FRAME AND PRESELECTOR MODULE

## 6.1 GENERAL

Chapter six provides the necessary information for checking the Main Frame circuitry and Preselector Module (724-1650) of the RF-505 Receiver.

The Main Frame consists of the front panel controls, switches, and indicators; the rear panel connectors; and the interconnecting harness.

The Preselector Module contains the 10 MHz and 1 MHz FREQUENCY MHz switches, the Synthesizer Regulator Assembly (724-0232) and the rf gain control.

Included in this chapter are the FREQUENCY MHz switches binary decimal code (BCD) and steering voltage checks, Preselector test, and rf gain control test. Main Frame, Preselector Module, and Synthesizer Regulator Assembly circuit diagrams and parts list are also included.

## 6.2 FREQUENCY MHz SWITCHES CHECK

To check for the correct BCD input to the Synthesizer Module proceed as follows:

a. Set MODE switch at OFF and remove the Synthesizer Module from the unit, refer to Chapter 5, paragraph 5.5.1.

b. Using an ohmmeter check for the proper information (open or ground) on the pins of Synthesizer Module main frame connector P0501 for each position of switch S3 through S8.

**NOTE**

*The following tables, 6.1 through 6.6, list the switch positions with the corresponding BCD information.*

Table 6.1 — 10 MHz Switch S3

| SWITCH POSITION | P0501 PIN NO.'S | | |
|---|---|---|---|
| | 11 | R | P |
| 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 0 |

0 = GROUND
1 = OPEN CIRCUIT

Table 6.2 — 1 MHz Switch S4

| SWITCH POSITION | P0501 PIN NO.'S (FUNCTION) | | | | |
|---|---|---|---|---|---|
| | U ($2^0$) | S ($2^1$) | V ($2^2$) | T ($2^3$) | 13 (Carry) |
| 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 |
| 2 | 0 | 0 | 0 | 1 | 0 |
| 3 | 1 | 1 | 1 | 0 | 0 |
| 4 | 0 | 1 | 1 | 0 | 0 |
| 5 | 1 | 0 | 1 | 0 | 0 |
| 6 | 0 | 0 | 1 | 0 | 0 |
| 7 | 1 | 1 | 0 | 0 | 0 |
| 8 | 0 | 1 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 0 | 0 |

0 = GROUND
1 = OPEN CIRCUIT

Table 6.3 — 100 kHz Switch S5

| DIAL POSITION | P0501 PIN NO.'S (FUNCTION) | | | | |
|---|---|---|---|---|---|
| | 15 ($2^0$) | 17 ($2^1$) | 16 ($2^2$) | 18 ($2^3$) | 14 (Enable) |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 1 | 1 |
| 2 | 0 | 0 | 0 | 1 | 1 |
| 3 | 1 | 1 | 1 | 0 | 1 |
| 4 | 0 | 1 | 1 | 0 | 1 |
| 5 | 1 | 0 | 1 | 0 | 1 |
| 6 | 0 | 0 | 1 | 0 | 1 |
| 7 | 1 | 1 | 0 | 0 | 1 |
| 8 | 0 | 1 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 0 | 1 |

0 = GROUND
1 = OPEN CIRCUIT

Table 6.4 — 10 kHz Switch S6

| DIAL POSITION | P0501 PIN NO.'S (FUNCTION) | | | |
|---|---|---|---|---|
| | A ($2^0$) | 8 ($2^1$) | 9 ($2^2$) | B ($2^3$) |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

0 = GROUND
1 = OPEN CIRCUIT

Table 6.5 — 1 kHz Switch S7

| DIAL POSITION | P0501 PIN NO.'S (FUNCTION) | | | |
|---|---|---|---|---|
| | K ($2^0$) | C ($2^1$) | 5 ($2^2$) | 7 ($2^3$) |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

0 = GROUND
1 = OPEN CIRCUIT

Table 6.6 — 100 Hz Switch S8

| DIAL POSITION | P0501 PIN NO.'S (FUNCTION) | | | |
|---|---|---|---|---|
| | J ($2^0$) | E ($2^1$) | H ($2^2$) | D ($2^3$) |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

0 = GROUND
1 = OPEN CIRCUIT

## 6.3 STEERING VOLTAGE CHECKS

To check for the proper steering voltage at the Synthesizer Module proceed as follows:

a. Set MODE switch at OFF and remove the Synthesizer Module, refer to Chapter 5, paragraph 5.5.1.

b. Using a dc vtvm connect the ground lead to the RF-505 chassis and the positive lead to the pin listed below in tables 6.7 or 6.8.

c. Set MODE switch at LSB and check each position of the switch for the proper voltage.

Table 6.7 – HF VCO Steering Voltage

| 10 kHz FREQUENCY MHz SWITCH S6 POSITION | J0501 PIN 2 VOLTAGE |
|---|---|
| 0 | 3.40 |
| 1 | 3.88 |
| 2 | 4.48 |
| 3 | 5.18 |
| 4 | 5.88 |
| 5 | 6.79 |
| 6 | 8.00 |
| 7 | 9.40 |
| 8 | 10.90 |
| 9 | 12.00 |

**NOTE**

*The reading for table 6.7 and table 6.8 reflect a power supply voltage of 12.00 vdc.*

Table 6.8 – VHF VCO Steering Voltage

| 1 MHz FREQUENCY MHz SWITCH S4 POSITION | J0501 PIN 6 VOLTAGE |
|---|---|
| 0 | 1.00 |
| 1 | 1.30 |
| 2 | 1.90 |
| 3 | 2.30 |
| 4 | 3.00 |
| 5 | 4.00 |
| 6 | 5.30 |
| 7 | 6.99 |
| 8 | 9.48 |
| 9 | 12.00 |

## 6.4 PRESELECTOR AND RF GAIN CONTROL TEST

To test for proper operation of the Preselector Module perform the following test procedures.

### 6.4.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Rf signal generator – HP, Model 606.

b. RF vtvm – Boonton, Model 91C with 50 ohm BNC termination.

c. Coax test cable – RF P/N 724-0032.

d. Adapter, BNC to miniature – Sealectro No. 51-074-6800.

### 6.4.2 PRELIMINARY

a. Refer to chapter 5, paragraph 5.5.1, and remove the Synthesizer Module from the RF-505.

b. Connect the coax test cable (paragraph 6.4.1c) to the rf signal generator. Connect the coax adapter (paragraph 6.4.1d) to the 50 ohm termination on the rf vtvm.

c. Connect the coax adapter to the coax test cable.

d. At the rf signal generator set frequency at 2 MHz, cw output at zero microvolts.

e. At the rf vtvm set range switch at 1 Vrms. Adjust rf signal generator output level until the rf vtvm indicates 0 dB. Do not readjust rf signal generator.

f. Disconnect the coax adapter and coax test cable and connect them to the two coax connectors J1651 and J1653, on the rear panel of the Preselector Module.

## 6.4.3 PROCEDURES

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | As outlined in paragraph 6.4.2 for step 2 through 20. | Perform procedures of paragraph 6.4.2 | |
| 2. | | Set MODE switch at OFF, 10 MHz and 1 MHz FREQUENCY MHz switches at 0. Set RF GAIN control fully clockwise and Preselector Select switch at OUT. Record the rf vtvm indication. | Between 0 and 0.5 dB. |
| 3. | | Adjust rf signal generator output for 0 dB on rf vtvm. | Adjusted for 0 dB. |
| 4. | | Set RF GAIN control fully counterclockwise and record rf vtvm indication. | Greater than 35 dB decrease. |
| 5. | | Set Preselector Select switch at IN. Set 1 MHz FREQUENCY MHz switch at 2 and RF GAIN control fully clockwise. Adjust Preselector Tune control for a peak indication on the rf vtvm. | Between 0 and 1.5 dB decrease from reference of step 3. |
| 6. | | At rf signal generator adjust output level for 0 dB indication on rf vtvm. | Adjusted for 0 dB. |
| 7. | | Set 1 MHz FREQUENCY MHz switch first at 3 and then at 4 while observing rf vtvm. Leave switch at position 4. | Less than 0.25 dB change. |
| 8. | | At rf signal generator set frequency first at 1.5 MHz and then at 2.5 MHz while observing rf vtvm. | More than 15 dB decrease at both frequencies from reference of step 6. |
| 9. | | At rf signal generator set frequency at 35 MHz and observe rf vtvm. | More than 10 dB decrease from reference of step 6. |
| 10. | | Set rf vtvm to 1 V range. Set Preselector Select switch at OUT, rf signal generator at 5 MHz and adjust output level for 0 dB on rf vtvm. | Adjusted to 0 dB. |
| 11. | | Set Preselector Select switch at IN and adjust Preselector Tune control for a peak indication on the rf vtvm. | Between 0 and 1.5 dB decrease from reference of step 10. |
| 12. | | At rf signal generator set frequency first at 2.5 MHz and then at 7.5 MHz while observing the rf vtvm. | More than a 15 dB decrease at both settings from level of step 11. |
| 13. | | Set 1 MHz FREQUENCY MHz switch at position 5 and repeat step 10 and 11 with rf signal generator set at 5 MHz. | Same as steps 10 and 11. |
| 14. | | Cycle 1 MHz FREQUENCY MHz switch at positions 6, 7, 8, and 9 while observing rf vtvm. | No more than a 0.25 dB decrease from reference of step 13. |
| 15. | | Set 1 MHz FREQUENCY MHz switch at position 9 and repeat steps 10 and 11 with rf signal generator set at 10 MHz. | Same as steps 10 and 11. |
| 16. | | Repeat step 12 with rf signal generator first set at 15 MHz and then at 7 MHz. | At least 15 dB below reference of step 15. |
| 17. | | Repeat steps 10 and 11 with rf signal generator set at 30 MHz and 10 MHz FREQUENCY MHz switch at 1. | Same as steps 10 and 11. |
| 18. | | Set 10 MHz FREQUENCY MHz switch at position 2 and observe rf vtvm indication. | Between 0 and 1.5 dB decrease from reference of step 17. |
| 19. | | Set 10 MHz and 1 MHz FREQUENCY MHz switches at positions 0, 0. Set rf signal generator at 1 MHz and rf vtvm at 1 V range. Adjust rf signal generator for a 0 dB indication on the rf vtvm. | Adjusted to 0 dB. |
| 20. | | At rf signal generator set frequency at 4 MHz and observe rf vtvm indication. | At least 20 dB decrease from reference of step 19. |

## 6.5 VFO TRACKING ALIGNMENT

To test for proper tracking of the 1 kHz FREQUENCY MHz switch during vfo operation proceed as follows:

### 6.5.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Rf signal generator – HP, Model 606.

b. Coax cable, RG-58/U terminated with male BNC connectors.

### 6.5.2 PRELIMINARY

a. Using the coaxial cable, connect the rf signal generator to RF-505 rear panel connector J1.

b. Connect the ac power cable to connector J3 and to a 117 vac, 60 Hz, 1 phase power source. Set rear panel POWER SELECT switch to AC.

c. At RF-505 front panel, set the following switches and controls to the positions listed.

| Switch or Control | Position |
|---|---|
| FREQUENCY MHz switches | 01.6000 MHz |
| SQUELCH control | Fully clockwise |
| MODE switch | LSB |
| SPEAKER switch | LOCAL |
| PRESELECTOR switch | OUT |
| VOLUME control | Midrange |
| RF GAIN control | Fully clockwise |

d. At rf signal generator, set controls for a cw output signal of 1.6 MHz at 100 microvolts. Fine tune the frequency for an audio signal (beat tone) at the RF-505 speaker.

### 6.5.3 PROCEDURES

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Refer to paragraph 6.5.2 and perform steps a through d. | |
| 2. | Front panel speaker for steps 2 through 6. | At RF-505 set 1 kHz FREQUENCY MHz switch at 9. Fine tune rf signal generator for a beat tone. | |
| 3. | | Pull out on 1 kHz FREQUENCY MHz switch to energize vfo. Do not rotate switch. | Adjust R35, refer to figure 5.1, for the same beat tone as obtained in step 2. |
| 4. | | Push in on the 1 kHz FREQUENCY MHz switch and rotate it to position 0. Readjust rf signal generator for a beat tone. | |
| 5. | | Pull out on the 1 kHz FREQUENCY MHz switch to re-energize the vfo. Do not rotate the switch. | Adjust R37, refer to figure 5.1, for the same beat tone as obtained in step 4. |
| 6. | | Repeat steps 2 through 5 until adjustment interaction is minimized and the results are acceptable. | |

## 6.6 CIRCUIT DIAGRAMS AND PARTS LISTS

**NOTE**

*The parts lists of the main frame and assemblies are located on the backs of the circuit diagrams.*

# NOTES

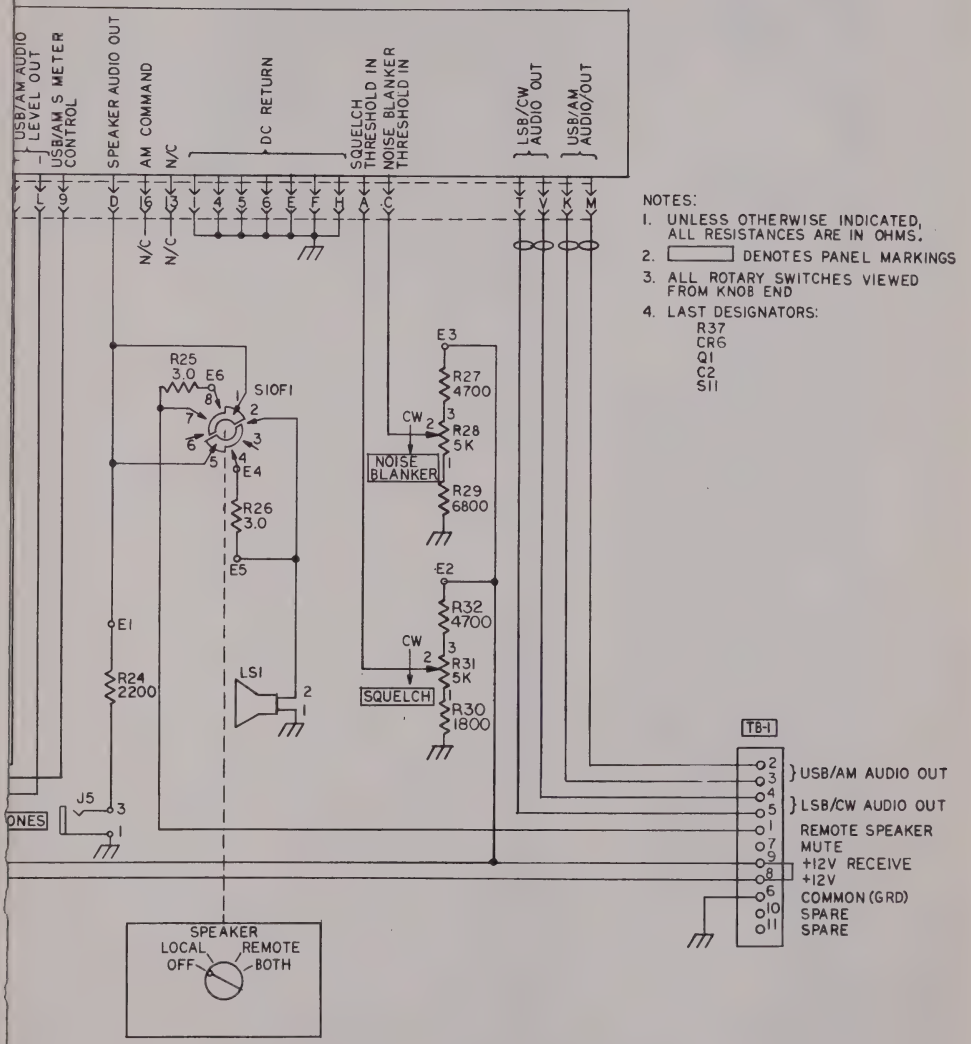



Figure 6.1 — RF-505 Receiver Main Frame Circuit Diagram

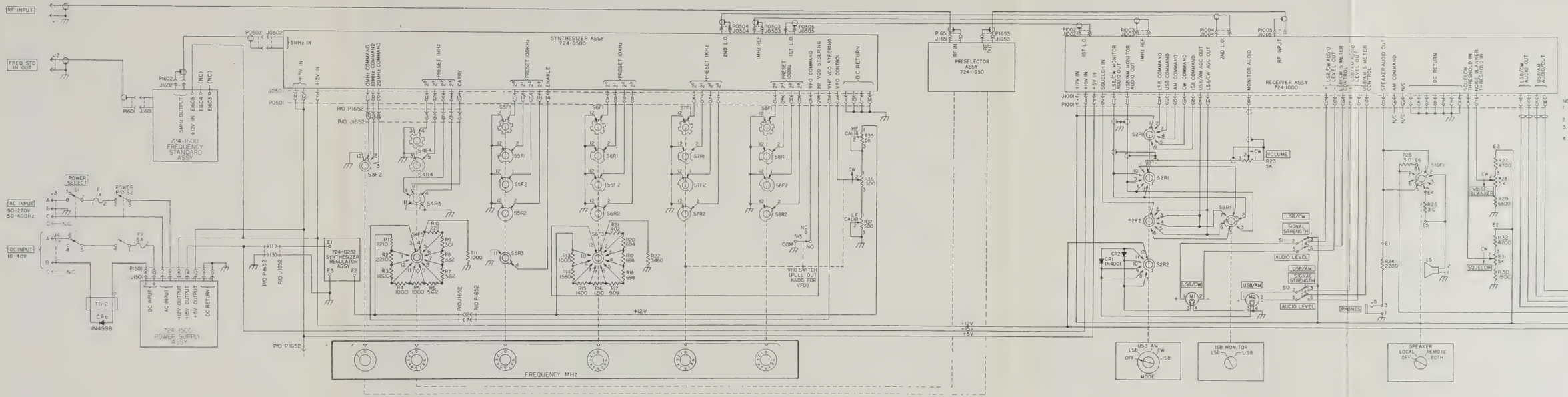



Figure 6.1 – RF-505 Receiver Main Frame Circuit Diagram

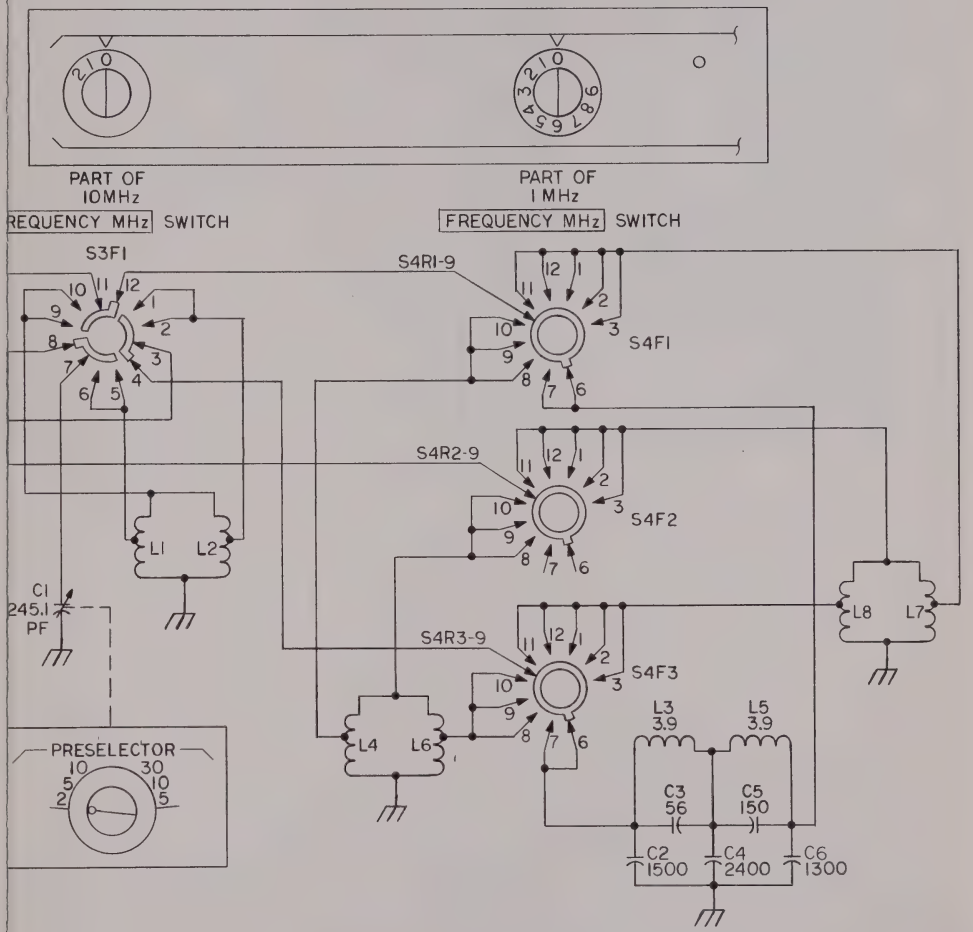



Figure 6.2 – Preselector Module Circuit Diagram

## MAIN FRAME – 724-0110

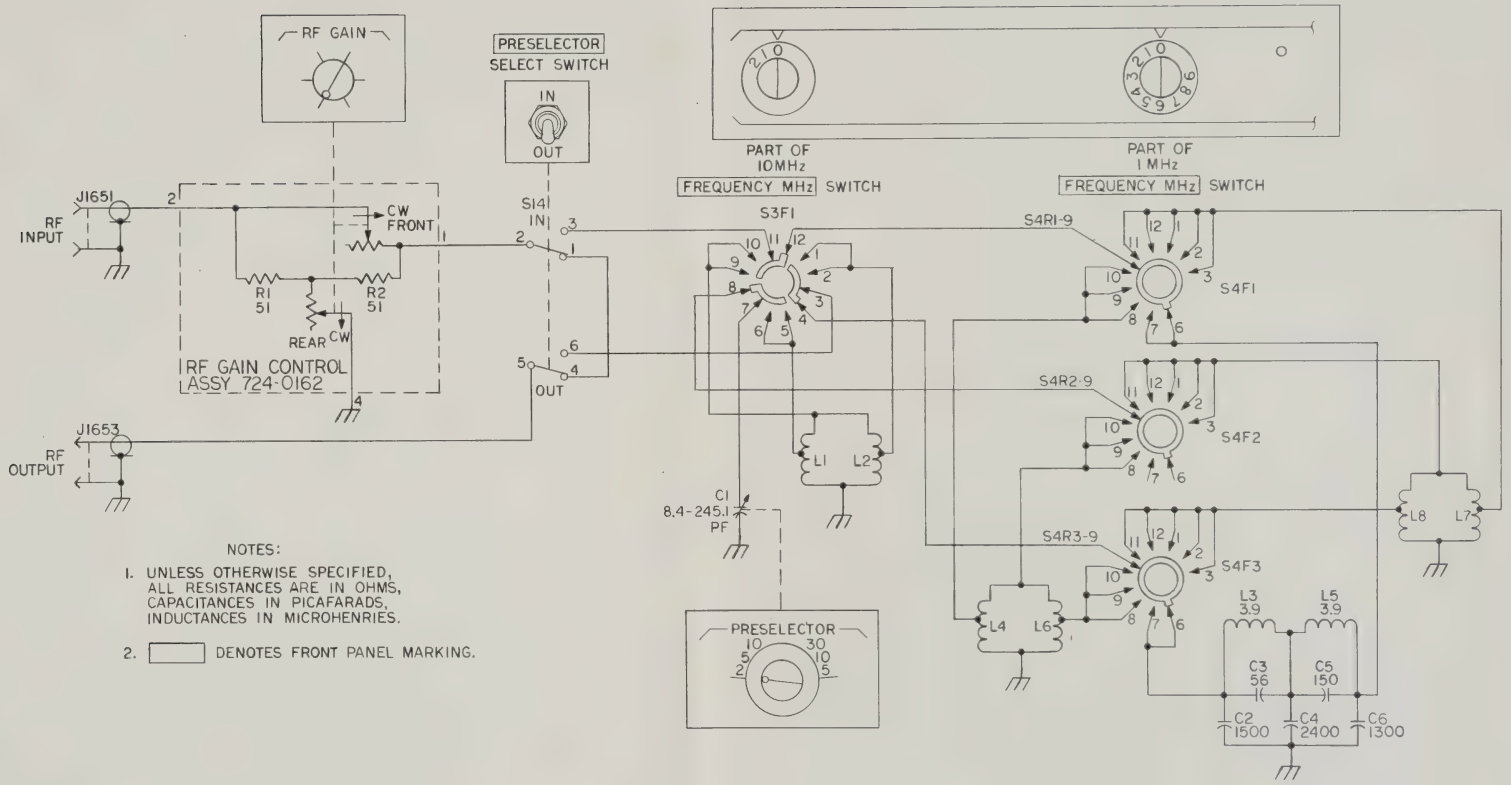
| Reference Designation | Description | RF P/N |
|---|---|---|
| CR1 | Diode, Silicon, Type 1N4001 | CR-0043 |
| CR2 | Diode, Silicon, Type 1N4001 | CR-0043 |
| CR6 | Diode, Silicon, Type 1N4998 | CR-0666 |
| F1 | Fuse, 3AG Quick Acting; 1A | F-0010 |
| F2 | Fuse, 3AG Quick Acting; 5A | F-0015 |
| J1 | Connector, Coaxial BNC | 724-0038 |
| J2 | Connector, Coaxial BNC | 724-0038 |
| J3 | Connector, AC Power | 724-0146 |
| J4 | Connector, DC Power | 724-0147 |
| J5 | Jack, Phone | J-0102 |
| LS1 | Speaker | 724-0172 |
| M1 | Meter | 724-0170 |
| M2 | Meter | 724-0170 |
| P0501 | Connector, P.C. Board | 724-0142 |
| P0502 | Connector, Coaxial, Female | P-0032 |
| P0503 | Connector, Coaxial, Female | P-0032 |
| P0504 | Connector, Coaxial, Female | P-0032 |
| P0505 | Connector, Coaxial, Female | P-0032 |
| P1001 | Connector, P.C. Board | 724-0142 |
| P1002 | Connector, Coaxial, Female | P-0032 |
| P1003 | Connector, Coaxial, Female | P-0032 |
| P1004 | Connector, Coaxial, Female | P-0032 |
| P1005 | Connector, Coaxial, Female | P-0032 |
| P1501 | Connector, Power, 14 Pin | P-0051 |
| P1601 | Connector, Coaxial, Female | P-0032 |
| P1602 | Connector, Coaxial, Female | P-0032 |
| P1651 | Connector, Coaxial, Female | P-0032 |
| P1652 | Connector Board Assembly | 724-1680 |
| P1653 | Connector, Coaxial, Male | P-0014 |
| *R1 | Resisotr, Metal Film; 2210 ohms ±1%; 1/8W | R-7279 |
| *R2 | Resistor, Metal Film; 2210 ohms ±1%; 1/8W | R-7279 |
| *R3 | Resistor, Metal Film; 1820 ohms ±1%; 1/8W | R-7292 |
| *R4 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| *R5 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| *R6 | Resistor, Metal Film; 562 ohms ±1%; 1/8W | R-7293 |
| *R7 | Resistor, Metal Film; 562 ohms ±1%; 1/8W | R-7293 |
| *R8 | Resistor, Metal Film; 332 ohms ±1%; 1/8W | R-7295 |
| *R9 | Resistor, Metal Film; 301 ohms ±1%; 1/8W | R-7271 |
| *R10 | Resistor, Metal Film; 221 ohms ±1%; 1/8W | R-7294 |
| *R11 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| R13 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| R14 | Resistor, Metal Film; 1580 ohms ±1%; 1/8W | R-7291 |
| R15 | Resistor, Metal Film; 1400 ohms ±1%; 1/8W | R-7281 |
| R16 | Resistor, Metal Film; 1210 ohms ±1%; 1/8W | R-7290 |
| R17 | Resistor, Metal Film; 909 ohms ±1%; 1/8W | R-7282 |
| R18 | Resistor, Metal Film; 698 ohms ±1%; 1/8W | R-7274 |
| R19 | Resistor, Metal Film; 698 ohms ±1%; 1/8W | R-7274 |
| R20 | Resistor, Metal Film; 604 ohms ±1%; 1/8W | R-7272 |
| R21 | Resistor, Metal Film; 402 ohms ±1%; 1/8W | R-7273 |
| R22 | Resistor, Metal Film; 3480 ohms ±1%; 1/8W | R-7289 |
| R23 | Resistor, Variable; 5K ±20%; 1W | R-7192 |
| R24 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R25 | Resistor, Wirewound; 3 ohms ±5%; 5W | R-0603 |
| R26 | Resistor, Wirewound; 3 ohms ±5%; 5W | R-0603 |
| R27 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R28 | Resistor, Variable; 5K ±20%; 2W | R-7193 |
| R29 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R30 | Resistor, Carbon; 1800 ohms ±10%; 1/4W | R-0027 |
| R31 | Resistor, Variable; 5K ±20%; 2W | R-7193 |
| R32 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R35 | Resistor, Variable; 5K ±10%; 1/2W | R-4045 |
| R36 | Resistor, Variable; 1500 ohms ±10%; 2W | R-0978 |
| R37 | Resistor, Variable; 500 ohms ±10%; 5W | R-0979 |
| S1 | Switch, Toggle, DPDT | S-0201 |
| S2 | Switch, Rotary | 724-0016 |
| *S3 | Switch, Rotary | 724-0010 |
| *S4 | Switch, Rotary | 724-0011 |
| S5 | Switch, Rotary | 724-0012 |
| S6 | Switch, Rotary | 724-0013 |
| S7 | Switch, Rotary | 724-0014 |
| S8 | Switch, Rotary | 724-0015 |
| S9 | Switch, Rotary | 724-0017 |
| S10 | Switch, Rotary | 724-0018 |
| S11 | Switch, Toggle, DPDT | S-0201 |
| S12 | Switch, Toggle, DPDT | S-0201 |
| S13 | Switch, Micro | 724-0175 |
| TB1 | Terminal Block | TB-0160 |
| TB2 | Terminal Block | TB-0623 |
| | Synthesizer Module Assembly | 724-0500 |
| | Receiver Module Assembly | 724-1000 |
| | Power Supply Module Assembly | 724-1500 |
| | Frequency Standard Module Assembly | 724-1600 |
| | Preselector Module Assembly | 724-1650 |
| | Synthesizer Regulator Assembly | 724-0232 |
| | 10 kHz Switch Assembly (S6) | 724-0165 |
| | 1 kHz Switch and VFO Assembly (S7) | 724-0155 |
| | Fuseholder | X-0006 |
| | Phone Jack Cover | MP-4335 |

*Located on Preselector Module

## MAIN FRAME – 724-0110 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| | Handle | H-4287 |
| | Speaker Grill | 724-0180 |
| | Knob, 10 MHz | 724-0190 |
| | Knob, 1 MHz | 724-0141 |
| | Knob, 100 kHz | 724-0141 |
| | Knob, 10 kHz | 724-0141 |
| | Knob, 1 kHz | 724-0141 |
| | Knob, 100 Hz | 724-0140 |
| | Knob, MODE | MP-0000 |
| | Knob, Noise Blanker | MP-0200 |
| | Knob, SPEAKER | MP-0200 |
| | Knob, SQUELCH | MP-0200 |
| | Knob, ISB MONITOR | MP-0200 |
| | Knob, RF GAIN | MP-0200 |
| | Knob, PRESELECTOR | MP-0200 |
| | Skirt, PRESELECTOR | 724-0192 |
| | Ratio Drive, PRESELECTOR | 162-0132 |

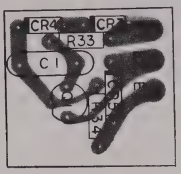
*Located on Preselector Module




NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES IN PICAFARADS, INDUCTANCES IN MICROHENRIES.
2. [ ] DENOTES FRONT PANEL MARKING.

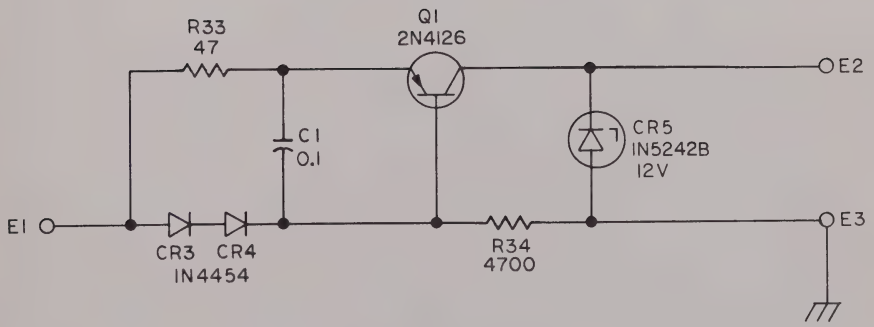
Figure 6.2 – Preselector Module Circuit Diagram




DC VOLTAGES*

| Stage | E | B | C |
|---|---|---|---|
| Q1 | 11.5 V | 13.5 V | 11.0 V |

*Referenced to ground.

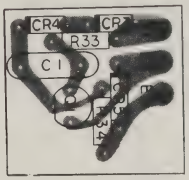



NOTES:
1. ALL RESISTANCES IN OHMS.
2. ALL CAPACITANCES IN MICROFARADS.

Figure 6.3 – Synthesizer Regulator Assembly Circuit Diagram

## PRESELECTOR – 724-1650

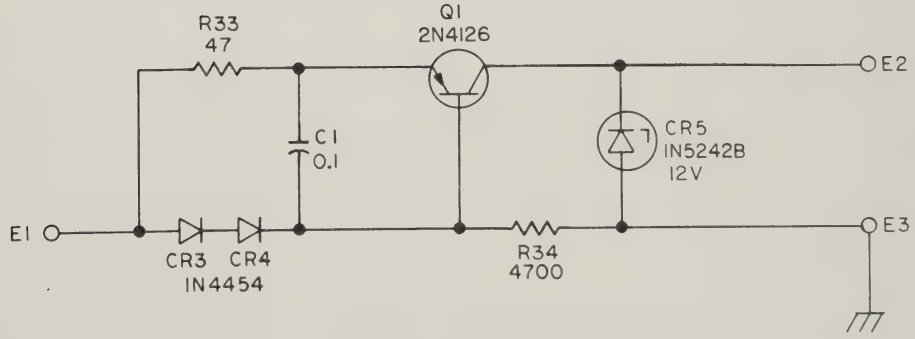
| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Air, Variable, 8.4-245.1 PF | 724-1661 |
| C2 | Capacitor, Mica, 1500 PF ±5%; 500 Vdcw | C-0156 |
| C3 | Capacitor, Mica, 56 PF ±5%; 500 Vdcw | C-0120 |
| C4 | Capacitor, Mica, 2400 PF ±5%; 500 Vdcw | C-0161 |
| C5 | Capacitor, Mica, 150 PF ±5%; 500 Vdcw | C-0130 |
| C6 | Capacitor, Mica, 1300 PF ±5%; 500 Vdcw | C-0155 |
| J1651 | Connector, Coaxial, Female | J-0034 |
| J1652 | Connector Board Assembly | 724-1680 |
| J1653 | Connector, Coaxial, Male | J-0030 |
| L1 | Coil, Toroid, 10-30 MHz | 724-1652 |
| L2 | Coil, Toroid, 10-30 MHz | 724-1652 |
| L3 | Coil, Rf, Molded, 3.9 UH | L-0623 |
| L4 | Coil, Toroid, 2-5 MHz | 724-1653 |
| L5 | Coil, Rf, Molded, 3.9 UH | L-0623 |
| L6 | Coil, Toroid, 2-5 MHz | 724-1653 |
| L7 | Coil, Toroid, 5-10 MHz | 724-1654 |
| L8 | Coil, Toroid, 5-10 MHz | 724-1654 |
| R1 | Resistor, Metal Film; 2210 ohms ±1%; 1/8W | R-7279 |
| R2 | Resistor, Metal Film; 2210 ohms ±1%; 1/8W | R-7279 |
| R3 | Resistor, Metal Film; 1820 ohms ±1%; 1/8W | R-7292 |
| R4 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| R5 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| R6 | Resistor, Metal Film; 562 ohms ±1%; 1/8W | R-7293 |
| R7 | Resistor, Metal Film; 562 ohms ±1%; 1/8W | R-7293 |
| R8 | Resistor, Metal Film; 332 ohms ±1%; 1/8W | R-7295 |
| R9 | Resistor, Metal Film; 301 ohms ±1%; 1/8W | R-7271 |
| R10 | Resistor, Metal Film; 221 ohms ±1%; 1/8W | R-7294 |
| R11 | Resistor, Metal Film; 1000 ohms ±1%; 1/8W | R-7270 |
| S3 | Switch, Rotary | 724-0010 |
| S4 | Switch, Rotary | 724-0011 |
| S14 | Switch, Toggle, DPDT | S-0287 |
| | Rf Gain Control Assembly | 724-0162 |
| | Synthesizer Regulator Board Assembly | 724-0232 |




DC VOLTAGES*

| Stage | E | B | C |
|---|---|---|---|
| Q1 | 11.5 V | 13.5 V | 11.0 V |

*Referenced to ground.




NOTES:
1. ALL RESISTANCES IN OHMS.
2. ALL CAPACITANCES IN MICROFARADS.

Figure 6.3 – Synthesizer Regulator Assembly Circuit Diagram

## SYNTHESIZER REGULATOR BOARD ASSEMBLY – 724-0232

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Zener, 12V ±5%, Type 1N5243B | CR-0261 |
| Q1 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| R33 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R34 | Resistor, Carbon; 12K ±10%; 1/4W | R-0037 |

# CHAPTER 7
# RECEIVER MODULE

## 7.1 GENERAL

This chapter contains the detailed theory of operation of each assembly in the Receiver Module. Also included are the necessary alignment and troubleshooting procedures to maintain the module and assemblies to specified performance. Circuit diagrams and parts list of the Receiver Module and assemblies are included.

## 7.2 DETAILED THEORY OF OPERATION

### 7.2.1 GENERAL

The theory of operation of each of the assemblies in the Receiver Module is presented in the following paragraphs. Refer to chapter 4 for the overall theory of the unit and of the Receiver Module.

### 7.2.2 FRONT END ASSEMBLY (724-1100)

Front End Assembly 724-1100 is designed to convert the desired received signal progressively to 156.0 MHz (first if.) and to 500 kHz (second if.). Injection signals for mixing are supplied by the synthesizer module. One injection signal is at 156.5 MHz, while the other is always 156.0 MHz higher than the desired operating frequency. Front End Assembly 724-1100 consists of an input low pass filter, an up-converter, a 156.0 MHz bandpass filter, two if. amplifiers, and an agc diode, a down mixer, a broadband output amplifier, and two injection amplifiers each with a level detector diode.

The input received signal, from the antenna, is applied to pin A of J1101, where it is coupled through a low pass filter to the signal port of up-converter A1. The low pass filter, consisting of capacitors C3, C4, C7 and C8, and inductors L1, and L2, attenuates all received signals that are above 35 MHz. This prevents desensitization of the receiver by large high frequency signals that are out of the desired band. It also serves to attenuate the receivers image response to the specified level, and prevent undesired radiation of the receiver's injection signals.

The output of the first local oscillator amplifier, Q1, is coupled to the local oscillator port of up-converter A1. The frequency of the first local oscillator signal is controlled by the positions of the FREQUENCY MHz switches, and is always 156.0 MHz higher than the desired operating frequency. Transistor Q1 amplifies the first local oscillator input signal to the level required to drive the up-converter, A1. The collector of Q1 is broadly tuned by T1 to cover the range of approximately 156 MHz to 186.0 MHz, which is the operating range of the first local oscillator injection signal. Diode CR1 detects the injection voltage being applied to up-converter A1, and provides a control voltage proportional to the injection level. This voltage is filtered by C5, L4, and C2, and is coupled to pin E by R1. The control dc voltage is applied to the synthesizer, by way of the first local oscillator injection coax to control the synthesizer output amplitude so that the injection level at A1 remains constant.

Up-converter A1 is a balanced diode ring which mixes the incoming signal from the antenna with the first local oscillator injection, and produces sum and difference frequencies. Bandpass filter FL1 selects the difference frequency, which is 156.0 MHz, as the first if. frequency. This if. signal is amplified by Q2, a junction field effect transistor, and applied across agc diode CR2. Diode CR2 is a PIN type diode, whose rf resistance is controlled by the delayed agc voltage applied to pin P by the Detector/AGC assembly and causes the rf resistance of CR2 to decrease as the delayed voltage decreases toward zero. This decreases the load resistance on Q2, and causes the gain of that stage to decrease. This decrease continues until the output of the front end assembly is reduced to the correct level, at which point the delayed level applied to pin P stabilizes and the gain of the front end assembly remains constant until the received signal level changes.

The if. signal appearing across CR2 is simultaneously applied to Q3, which is a junction field effect transistor, where it is further amplified and then applied to one of the control gates of the down mixer, Q4.

Transistor Q4 is a dual insulated gate field effect transistor, which mixes the first if. frequency (156.0 MHz) with the second local oscillator injection signal (156.5 MHz). The difference frequency, 500 kHz nominal, is selected by a low pass filter network at the input to broadband amplifier Q5. The low pass filter, consisting of capacitors C31, and C33, and inductors L14, and L15 attenuates the undesired sum mixing product and both the first if. and second local oscillator frequencies.

Broadband amplifier Q5 and feedback amplifier Q6, Q7 provide the final amplification at the second if. frequency (500 kHz) on the front end assembly. The gain of Q5 is adjusted by variable resistor R26 to provide an overall gain of 23 dB in the front end assembly. From the emitter of Q7 the receive output signal is coupled through a series resonant filter and two matching resistors to the receive output terminals. Resistors R28 and R26 comprise the feedback loop around feedback amplifier Q6, Q7, and maintain constant gain in those stages. The series resonant output filter is composed of capacitor C43 and inductor L21, which are resonant at 500 kHz, and serve to prevent undesired signals from reaching Filter Assemblies 724-1150 and 724-1175.

Second local oscillator amplifier Q8 is identical in operation to Q1, and supplies a constant level injection signal at 156.5 MHz to the second control gate of down mixer Q4. Diode CR3 is identical in operation to CR1, and supplies a control voltage to the synthesizer module in the same fashion.

### 7.2.3 FILTER ASSEMBLIES (724-1150 and 724-1175)

Usb/Am. Filter Assembly 724-1150 selects the upper sideband or am. if. signal where as the Lsb/Cw Filter Assembly 724-1175 selects the lower sideband or cw if. signal. Selection of the proper sideband if. signal or am. if. signal is accomplished by filters, either mechanical or ceramic, which are inserted into the signal flow by diode switches. Each assembly consists of four diode switches (two input/output pairs), two filters (the cw filter on the 724-1175 assembly is optional), two integrated circuit if. amplifier stages, an emitter follower output stage, and an input buffer amplifier stage. With the exception of different filters, the two assemblies are identical in circuitry and operation. In the following theory of operation discussion the stages and filters of each assembly are explained separately.

The nominal 500 kHz second if. received signal is amplified by input buffer amplifier Q1 and applied to the two input diode switches, CR1 and CR2. Depending on the mode selected by the operator, one of the diode switches will be forward biased to couple the received signal to the filter corresponding to the operating mode. The filtered if. output signal from the selected filter is coupled through the output diode switch, either CR3 or CR4, to the input of first if. amplifier A1. If. amplifier A1 and A2 are integrated circuit amplifiers with their gain controlled by the agc signal from the Detector/Agc Assembly. From the output of second if. amplifier A2 the received signal is applied to emitter follower Q2. Emitter follower Q2, provides impedance matching for the output signal to the input of the Detector/Agc Assembly.

a. Input Buffer Amplifier Q1

Input buffer amplifier Q1 provides the initial amplification of the nominal 500 kHz if. signal from Front End Assembly 724-1100. The input signal is coupled to the base of Q1 by capacitor C1, amplified, and applied to diode switches CR1, CR2 by capacitors C4. The collector circuitry of Q1 is tuned to 500 kHz by T1 and C7 for increased selectivity of the received signal.

b. Diode Switches CR1/CR3, CR2/CR4

Diode switches CR1/CR3 and CR2/CR4 insert the proper filter into the received if. signal path and couple the filter if. output signal to first if. amplifier A1. Filter FL1 (usb filter on 724-1150 assemblies or lsb filter on 724-1175 assemblies) is inserted into the if. signal path by diodes CR1 and CR3. The diodes are forward bias by a positive dc voltage at pin H, filter number one command. Filter FL2 (am. filter on 724-1150 assemblies or cw filter (optional) on 724-1175 assemblies) is inserted into the if. signal path by diodes CR2 and CR4. These diodes are forward bias by a positive dc voltage at pin J, filter number two command.

c. Usb Filter (FL1) 724-1150 Assemblies

Usb filter on the 724-1150 assembly selects the higher frequency usb if. signal from the received signal. A mechanical filter, usb filter FL1 provides a passband of 500.3 kHz to 503.5 kHz with an adjacent sideband rejection of greater than 50 dB. The filter is selected by the USB or ISB positions of MODE switch and is inserted into the signal

path by diode CR1 and capacitor C31. The output is coupled to first if. amplifier A1 by capacitors C33, C13 and diode CR3.

d. Lsb Filter (FL1) 724-1175 Assemblies

Lsb filter on the 724-1175 assembly selects the lower frequency lsb if. signal from the received signal. A mechanical filter lsb filter FL1 provides a passband of 496.5 kHz to 499.7 kHz with an adjacent sideband rejection of greater than 50 dB. The filter is selected by the LSB or ISB positions of the MODE switch and is inserted into the signal path by diode CR1 and capacitor C31. The output is coupled to first if. amplifier A1 by capacitors C33, C13, and diode CR3.

e. Am. Filter (FL2) 724-1150 Assemblies

Am. filter on the 724-1150 assembly provides filtering of the received signal to select the received am. if. signal, upper sideband plus carrier. A ceramic filter, am. filter FL2 provides a nominal 10 kc bandwidth at 6 dB centered at 500 kHz. The filter is selected by the AM position of MODE switch and is inserted into the signal path by diode CR2, capacitor C32, and resistor R30. The output is coupled to first if. amplifier A1 by resistor R31, capacitors C34, C13, and diode CR4.

f. Cw Filter (FL2) (Optional) 724-1175 Assemblies

Cw filter on the 724-1175 assemblies provides a narrow bandwidth of 500 Hz for cw signals centered at 501.000 kHz. Adjacent channel sideband rejection is greater than 60 dB. The filter is selected only by the CW position of the MODE switch. It is inserted into the if. signal path by diode CR2 and capacitor C32. The output is coupled to first if. amplifier A1 by capacitor C34, C13, and diode CR4.

g. First If. Amplifier A1

If. amplifier A1, an integrated circuit amplifier, provides the initial amplification of the filtered if. signal. The input circuitry is tuned to 500 kHz by T2 and C14 to provide additional selectivity of the received signal.

Gain control for A1 is provided by the agc voltage applied to pin L of J1151 from the Detector/Agc Assembly. The output level from A1, applied to A2, is adjusted by the position of agc threshold control R17 for the overall gain of the assembly. The output if. signal at R17 is coupled by C19 to T3.

h. Second If. Amplifier A2

Second if. amplifier A2 provides the final amplification of the filtered if. signal. The input signal is applied to A2 by transformer T3, tuned to 500 kHz for selectivity of the received signal. The agc signal at pin L is also applied to A2 for gain control. Transformer T4, resistor R24, and capacitor C26 provide a tuned output circuit centered at 500 kHz.

i. Emitter Follower Q2

Emitter follower Q2 provides the impedance match for the output signal at pin U. Capacitor C27 couples the input signal to Q2 from transformer T4. The output if. signal is coupled by C28 and R24 to pin U.

7.2.4 DETECTOR/AGC ASSEMBLY (724-1200)

Detector/Agc Assembly 724-1200 contains the circuitry for detecting the audio intelligence from the 500 kHz if. signal. The assembly also provides the agc voltage, derived from the received signal level, to Front End Assembly 724-1100 and to the associated channel Filter Assembly 724-1150 or 724-1175.

The nominal 500 kHz received second if. signal from the Filter Assembly is applied at pin A of J1201 and coupled to product detector A1 and to am./agc amplifier Q1.

For ssb operation a 500 kHz reference signal is applied to product detector A1. This signal is derived from a 1 MHz reference signal (Synthesizer Module local oscillator number three output) applied to pin D of J1201. The 1 MHz reference signal is shaped by Q3 and applied as a clipped sine wave to divide by two flip-flop A2. Diodes CR1 and CR2 provide additional shaping of the input waveform. In product detector A1 the two signals are mixed with the resultant audio signal recovered at pin 6 by a low pass filter consisting of C13, C17, and R19. The audio signal is then applied to preamplifier/mode switch Q4. Transistor Q4 is switched on (forward biased) by the ssb command signal at pin J of J1201. The audio output from Q4 is applied to

line amplifier A4 and to monitor output, pin K of J1201.

The second if. signal at Q1 is amplified by Q1 and Q2 and applied to am./agc detector and agc amplifier A3 at pins 6 and 3.

The signal at pin 6 is applied to the agc detector and agc amplifier circuitry in A3 with the resulting agc signal extracted at pin 9 of A3. From pin 9 the agc signal is applied to pin 13 of J1201 (agc output to the associated Filter Assembly) and to R36 (delayed agc threshold adjust).

Variable resistor R36 is adjusted to provide a delayed agc voltage output at pin 14 of J1201, only for received signals that are too large to be effectively controlled by the agc signal at pin 13. The delayed agc signal is applied to the if. amplifier in the Front End Assembly to reduce the overall gain of the unit.

The agc signal is also applied to "S" meter amplifier Q6. Transistor Q6 provides an output signal at pin 12 of J1201, that reflects the signal strength of the received rf signal. This signal is selected by the SIGNAL STRENGTH position of the associated meter switch to provide a visual indication on the meter. Received am. signals at pin 6 of A3 are detected with the audio signal recovered by the low pass filter at pin 7 of A3. The higher frequency rf signal is shunted to ground by C20. The am. audio signal is then applied to preamplifier/mode switch Q5. Transistor Q5 is forward biased by the am. command mode at pin 10 of J1201, to provide the initial amplification of the detected am. audio signal. From Q5 the audio signal is coupled to line amplifier A4 and to monitor output, pin K of J1201.

The audio output of line amplifier A4, a balanced 600 ohm audio signal, is applied to pins V and T of J1201 and to the base of audio level meter amplifier Q9. Variable resistor R38 provides output control of the line amplifier. The audio output of Q9 is rectified by diode bridge CR5-CR8 and applied as a dc output voltage to pins S and U of J1201. The amplitude of the dc voltage reflects the audio level of the received signal.

### 7.2.5 SPEAKER DRIVER AND SQUELCH GATE ASSEMBLY (724-1250)

Speaker Driver and Squelch Gate Assembly 724-1250 provides the final stage of audio amplification and squelch control for the front panel speaker, PHONES jack, and rear panel remote speaker output terminal. The assembly consists of a squelch gate diode, a two transistor squelch comparator circuit, and an audio power amplifier. The audio output signal after amplification is applied to the front panel PHONES jack and to the SPEAKER switch. SPEAKER switch applies the audio signal to either the front panel speaker or rear panel remote speaker output terminal or both.

Audio signals from the MODE switch are applied to the cathode of squelch gate diode CR1. The dc voltage at the cathode of CR1 is controlled by the squelch comparator circuits to block the audio signal from the audio power amplifier when the signal level is below a predetermined level. This is accomplished by comparing the detected agc voltage, indicating the relative level of the rf signal, with an adjustable dc voltage controlled by the SQUELCH control. The position of the SQUELCH control determines the value of agc voltage at Q1 necessary to forward bias CR4. When forward biased, CR4 couples the audio signal to A1 where it is power amplified and applied to the output terminal, pin V of J1251.

## 7.3 PERFORMANCE CHECKS

Performance checks for the receiver module are presented in chapter 5 of this manual, paragraphs 5.3.4 through 5.3.8. If the unit fails one or more of the receiver module checks refer to the troubleshooting table in chapter 5 and to the Receiver Module troubleshooting procedures in this chapter.

**NOTE**

*For those checks that are only slightly out of tolerance perform the alignment procedures presented in this chapter. If the step is still out of tolerance proceed with the troubleshooting procedures of this chapter.*

## 7.4 FAULT ANALYSIS

The Receiver Module fault analysis table is presented in the following sub paragraphs. This table is designed to isolate a faulty assembly first and then a faulty stage. If the defective assembly has already been isolated, by substitution, then the technician can proceed directly to the appropriate paragraph and proceed from there to isolate the

faulty stage. Once a defective stage has been found refer to the appropriate circuit diagram and make voltage checks to locate the faulty component. Suspected faulty assemblies can be verified by substitution with a known good assembly.

**NOTE**

*After a defective assembly or component has been replaced proceed to the alignment procedures located in this chapter.*

7.4.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Rf Signal Generator – HP, Model 606

b. Rf Vtvm – Boonton, Model 91C

c. Oscilloscope – Tektronix, Model 453

d. Dc voltmeter – HP, Model 410C

e. Extender – RF Communications, RF P/N 724-0060

f. Coaxial cable terminated with male BNC connectors.

g. Coaxial adapter BNC to miniature – Sealectro No. 51-074-6800

7.4.2 PRELIMINARY

a. At rear panel connect rf signal generator to RF INPUT connector J1.

b. Set rf signal generator at 1.6 MHz, cw output at 150 mVrms.

c. At RF-505 set FREQUENCY MHz switches at 1.60000 MHz, set MODE switch at OFF. Set SPEAKER switch at LOCAL, RF GAIN control fully clockwise, and SQUELCH control fully counterclockwise. Set PRESELECTOR switch at OUT.

d. At RF-505 remove top and Receiver Module covers.

7.4.3 FRONT END ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 7.4.2.<br><br>Remove both Filter Assemblies and both Detector/Agc Assemblies from the Receiver Module. Using assembly extender (RF P/N 724-0060) extend the Front End Assembly for access.<br><br>At the Receiver Module disconnect P1002 (yellow) and P1004 (green). | |
| 2. | Rf vtvm at junction of L2, C8 and A1 on Front End Assembly. | At rf signal generator set rf output level at 80 mVrms and measure rf signal on Front End Assembly. | 165 ±20 mVrms |
| 3. | Rf vtvm at P1002 (yellow). | Terminate rf vtvm probe with 50 ohms. Set Mode switch at LSB and measure first local oscillator injection signal from Synthesizer Module. If signal is absent or incorrect refer to Synthesizer Module troubleshooting procedures. Reconnect P1002 to Receiver Module. | 150 ±50 mVrms |
| 4. | Rf vtvm at P1004 (green). | Terminate rf vtvm probe with 50 ohms. Set MODE switch at LSB and measure second local oscillator injection signal from Synthesizer Module. If signal is absent or incorrect refer to Synthesizer Module troubleshooting procedures. Reconnect P1004 to Receiver Module. | 100 ±50 mVrms |
| 5. | Rf vtvm at junction of FL1 and C12. | Set rf signal generator output at 80 mVrms and fine tune for a peak indication on the rf vtvm. Rotate FREQUENCY MHz switches and observe a decrease in the indication on the rf vtvm. Return switches to their original positions. | 25 ±10 mVrms |

## 7.4.3 FRONT END ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 6. | Rf vtvm at junction of C25 and L10. | At rf signal generator set output at 15 mVrms. Measure the voltage on the rf vtvm. | 150 ±50 mVrms |
| 7. | Rf vtvm at collector of Q5. | At rf signal generator set output at 15 mVrms and fine tune frequency for a peak indication on the rf vtvm. Rotate FREQUENCY MHz switches and observe a decrease in the indication on the rf vtvm. Return switches to their original positions. | 18 ±5 mVrms |
| 8. | RF vtvm at junction of L21 and C43. | At rf signal generator set output at 1.5 mVrms. Measure voltage on the rf vtvm. | 100 ±25 mVrms. The level is adjustable by R26. |
| 9. | Same as step 8. | Using a 10,000 ohm resistor, connect pin P of J1101 to ground. Measure voltage on the rf vtvm. | 45 ±13 mVrms. |

## 7.4.4 LSB/CW FILTER ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 7.4.2.<br>Remove both Detector/Agc Assemblies from the Receiver Module.<br>**NOTE**<br>*The Front End Assembly must be installed and operating within specifications for the following procedures.*<br>Extend Lsb/Cw Filter Assembly 724-1175 using the RF P/N 724-0060 extender. | |
| 2. | Rf vtvm at pin V of J1175. | Set MODE switch at LSB. At rf signal generator adjust output level and frequency adjust controls for a peak indication on the rf vtvm of 100 mVrms. | 100 mVrms. |
| 3. | Rf vtvm at junction C4, CR1 and CR2. | Measure voltage. | 600 ±100 mVrms. |
| 4. | Rf vtvm at junction of CR1 and C31. | Measure voltage. Observe zero indication with MODE switch at USB, AM, and CW.<br>**NOTE**<br>*Do not perform steps 5 and 6 if the optional cw filter is not installed on the 724-1175 Assembly.* | 600 ±100 mVrms. |
| 5. | Rf vtvm at junction of CR2 and C32. | Measure voltage with MODE switch at CW. Observe zero indication with MODE switch at LSB, USB, AM, and ISB. | 600 ±100 mVrms. |
| 6. | Rf vtvm at cathode of CR3. | Set MODE switch at CW. At rf signal generator fine tune frequency for a peak indication on the rf vtvm. | 200 ±50 mVrms. |
| 7. | Rf vtvm at cathode of CR3. | Set MODE switch at LSB. At rf signal generator fine tune frequency for a peak indication on the rf vtvm. | 275 ±50 mVrms. |
| 8. | Rf vtvm at pin 6 of A1. | Measure voltage. | 75 ±25 mVrms. |
| 9. | Rf vtvm at pin 6 of A2. | Measure voltage. | 500 ±100 mVrms. |
| 10. | Rf vtvm at pin A of J1151. | Measure voltage. | 750 ±250 mVrms. |

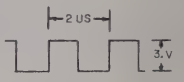
## 7.4.5 USB/AM FILTER ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 7.4.2.<br><br>Remove both Detector/Agc Assemblies from the Receiver Module.<br><br>**NOTE**<br><br>*The Front End Assembly must be installed and operating within specifications for the following procedures.*<br><br>Extend Usb/Am Filter Assembly 724-1150 using the RF P/N 724-0060 extender. | |
| 2. | Rf vtvm at pin V of J1150 | Set MODE switch at USB. At rf signal generator adjust output level and frequency adjust for a peak indication of 100 mVrms. | 100 mVrms. |
| 3. | Rf vtvm at junction of C4, CR1 and CR2. | Measure voltage. | 600 ±100 mVrms. |
| 4. | Rf vtvm at junction of CR1 and C31. | Measure voltage. Observe zero indication with MODE switch at LSB, AM, and CW. | 600 ±100 mVrms and zero. |
| 5. | Rf vtvm at junction of CR2 and C32. | Measure voltage with MODE switch at AM. Observe zero indication with MODE switch at USB, LSB, CW and ISB. | 600 ±100 mVrms and zero. |
| 6. | Rf vtvm at cathode of CR3. | Set MODE switch at USB. At rf signal generator fine tune frequency for a peak indication on the rf vtvm. | 275 ±25 mVrms. |
| 7. | Rf vtvm at cathode of CR3. | Set MODE switch at AM. At rf signal generator set output for 30% modulation at 1000 Hz and fine tune frequency for a peak indication on the rf vtvm. | |
| 8. | Rf vtvm at pin 6 of A1. | Measure voltage. | 200 ±25 mVrms. |
| 9. | Rf vtvm at pin 6 of A2. | Measure voltage. | 700 ±100 mVrms. |
| 10. | Rf vtvm at pin A of J1151. | Measure voltage.<br><br>**NOTE**<br><br>*The Performance Standard values listed above for steps 8, 9, and 10 are typical for assemblies aligned with factory test fixtures. The position of R17, which is adjusted to control the overall gain of the Receiver Module, will affect these readings. If R17 is re-adjusted for the value of step 8 then the alignment procedures must be re-checked, paragraph 7.5.* | 1.25 ±0.25 Vrms. |

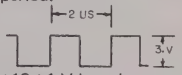
## 7.4.6 LSB/CW DETECTOR/AGC ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 7.4.2.<br><br>Remove both Detector/Agc Assemblies from the Receiver Module. | |

## 7.4.6 LSB/CW DETECTOR/AGC ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. (Cont.) | | **NOTE**<br>*The Front End Assembly and both Filter Assemblies must be installed and operating within specifications for the following procedures.*<br>Connect the extender into P1201 on the Receiver Module mother board, lsb position. Do not connect the Lsb/Cw Detector/Agc Assembly to the extender at this time. | |
| 2. | Rf vtvm at pin A of extender 724-0060. | Set MODE switch at LSB and adjust rf signal generator for a peak output at 100 mVrms. | 100 mVrms. |
| 3. | | Set MODE switch at OFF and connect the Lsb/Cw Detector/Agc Assembly to the extender. Set MODE switch at LSB. | |
| 4. | Oscilloscope probe at cathode of CR2. | Measure indicated sine wave. | 3 volts peak-to-peak 1 $\mu$sec period. |
| 5. | Oscilloscope probe at pin 8 of A2. | Measure indicated square wave. |  |
| 6. | Dc voltmeter probe at pin J of J1201. | Measure positive dc voltage with MODE switch at LSB and ISB. Observe zero indication with MODE switch at USB, CW, and AM. | |
| 7. | Oscilloscope probe at junction of R19 and C18. | Set MODE switch at LSB and fine tune rf signal generator frequency control for a peak indication on the displayed waveform. | Sine wave, 400 ±50 mVrms. peak-to-peak. Period variable with rf signal generator frequency control. |
| 8. | Oscilloscope probe at pin 3 of A3. | Same as step 7. | Same as step 7 with a 7 ±1 volt peak-to-peak sine wave. |
| 9. | Oscilloscope probe at pin 6 of A3. | Same as step 7. | Same as step 7 with a 5 ±1 volt peak-to-peak sine wave. |
| | | **NOTE**<br>*The value listed below for step 10 is typical. Actual measurements depend on position of R38 and will vary depending on system application.* | |
| 10. | Oscilloscope probe at collector of Q9. | At rf signal generator set output level at 1 mVrms. Set LSB/CW Meter switch at AUDIO LEVEL. | Sine wave 3 ±0.5 volts peak-to-peak. Period variable with rf signal generator frequency. Observe LSB/CW meter indication of +4 dBm. |
| 11. | Oscilloscope probe at pin K of J1201. | Same as step 10. | Sine wave 600 ±100 mV peak-to-peak. Period variable with rf signal generator frequency. |
| 12. | Dc voltmeter at TP2. | Disconnect rf signal generator and measure voltage. | Less than 0.5 Vdc. |
| 13. | Dc voltmeter at TP1. | Same as step 12. | +10 ±1 Vdc. |
| 14. | Dc voltmeter at TP2. | Reconnect rf signal generator. Set MODE switch at USB. Increase output level at rf signal generator until dc voltmeter indication starts to increase. Repeak dc voltmeter indication using the frequency control. Adjust output level at rf signal generator to 1 mVrms. | +4 ±1 Vdc. |
| 15. | Dc voltmeter at TP1. | Reduce rf signal generator output to zero and measure voltage. Increase rf signal generator output to 100 mVrms and record indication on dc voltmeter. | 10 ±1 Vdc and 8 ±1 Vdc. |

## 7.4.7 USB/AM DETECTOR/AGC ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 7.4.2.<br>Remove both Detector/Agc Assemblies from the Receiver Module.<br>**NOTE**<br>*The Front End Assembly and both Filter Assemblies must be installed and operating within specifications for the following procedures.*<br>Connect the extender into P1202 on the Receiver Module mother board, usb position. Do not connect the Usb/Am. Detector/Agc Assembly to the extender at this time. | |
| 2. | Rf vtvm at pin A of extender 724-0060 | Set MODE switch at USB and adjust rf signal generator for a peak output at 100 mVrms. | 100 mVrms. |
| 3. | | Set MODE switch at OFF and connect the Detector/Agc Assembly to the extender. Set MODE switch at USB. | |
| 4. | Oscilloscope probe at cathode of CR2. | Measure indicated sine wave. | 3 volts peak-to-peak 1$\mu$sec period. |
| 5. | Oscilloscope probe at pin 8 of A2. | Measure indicated square wave. |  |
| 6. | Dc voltmeter probe at pin J of J1201, ground lead at chassis. | Measure positive dc voltage with MODE switch at USB and ISB. Observe zero indication with MODE switch at LSB, CW, and AM. | +12 ±1 Vdc and zero. |
| 7. | Dc voltmeter probe at pin 10 of P1201, ground lead at chassis. | Measure positive dc voltage with MODE switch at AM. Observe zero indication with MODE switch at LSB, USB, CW, and ISB. | +12 ±1 Vdc and zero. |
| 8. | Oscilloscope probe at junction of R19 and C18. | Set MODE switch at USB and fine tune rf signal generator frequency control for a peak indication on the displayed wave form. | Sine wave, 400 mV peak-to-peak, ±50 mV. Period variable with rf signal generator frequency control. |
| 9. | Oscilloscope probe at pin 3 of A3. | Set MODE switch at USB and fine tune rf signal generator frequency control for a peak indication on the displayed waveform. | Sine wave, 7 ±1 volts peak-to-peak. Period variable with rf signal generator frequency control. |
| 10. | Oscilloscope probe at pin 6 of A3. | Same as step 9. | Same as step 9 with a 5 ±1 volt peak-to-peak sine wave. |
| 11. | Oscilloscope probe at junction of C21 and base of Q5. | Set MODE switch at AM. Set rf signal generator for 30% modulation at 1000 Hz. Fine tune frequency control for a peak indication.<br>**NOTE**<br>*The value listed below for step 12 is typical. Actual measurements depend on position of R38 and will vary depending on system applications.* | Sine wave 150 ±25 mV peak-to-peak at 1000 Hz. |
| 12. | Oscilloscope probe at collector of Q9. | Set MODE switch at USB. At rf signal generator set output for cw at 1 mVrm output. Fine tune frequency control for a peak indication. Set USB/AM. Meter switch at AUDIO LEVEL. | Sine wave 3 ±0.5 volts peak-to-peak. Period variable with rf signal generator frequency control. Observe front panel USB/AM. meter indicates +4 dBm. |

## 7.4.7 USB/AM DETECTOR/AGC ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 13. | Oscilloscope probe at pin K of J1201. | MODE switch at USB. Set rf signal generator to cw at 1 mVrm output. Fine tune frequency control for a peak indication. | Sine wave, 600 ±100 mV peak-to-peak. Period variable with rf signal generator frequency control. |
| | | MODE switch at AM. Set rf signal generator to 65% modulation at 1000 Hz and 1 mVrms output. | Sine wave, 400 mVrms peak-to-peak at 1000 Hz. |
| 14. | Dc voltmeter at TP2. | Disconnect rf signal generator and measure voltage. | Less than 0.5 Vdc. |
| 15. | Dc voltmeter at TP1. | Disconnect rf signal generator and measure voltage. | +10 Vdc. |
| 16. | Dc voltmeter at TP2. | Reconnect rf signal generator. Set MODE switch at USB. Increase output level at rf signal generator until dc voltmeter indication starts to increase. Repeak voltmeter indication using the frequency control. Adjust output at rf signal generator to 1 mVrms. | +4 ±1 Vdc. |
| 17. | Dc voltmeter at TP1. | Reduce rf signal generator output to zero and measure voltage. Increase rf signal generator output to 100 mVrms and measure voltage on voltmeter. | 10 ±1 Vdc and 8 ±1 Vdc. |

## 7.4.8 SPEAKER DRIVER AND SQUELCH GATE ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 7.4.2. | |
| | | **NOTE**<br>*All Receiver Module assemblies must be installed and operating within specifications for the following procedures.* | |
| | | Remove the Speaker Driver and Squelch Gate Assembly from the module and reinstall it using the 724-0060 extender. | |
| 2. | | Set MODE switch at LSB and adjust rf signal generator frequency control for a peak indication on the front panel LSB/CW meter. Set SPEAKER switch at OFF. | |
| | Dc voltmeter at pin D of J1251 | Rotate SQUELCH control from the full counterclockwise stop fully clockwise and observe voltage on voltmeter. | From 2.0 to 8.0 ±1 Vdc. |
| | Dc voltmeter at pin H of J1251 | At rf signal generator vary output from zero to 30 mVrms and observe voltage on voltmeter. | From 0 to 6 ±1 Vdc. |
| | Oscilloscope probe at TP1. | Measure displayed sine wave with VOLUME control fully clockwise. Rf signal generator at 30 mVrms. | 550 ±50 mVrms peak-to-peak. |
| | Oscilloscope probe at TP2. | Measure displayed sine wave. Adjust rf signal generator output until wave form just starts to clip. | Sine wave 5 ±1 volts peak-to-peak. |

## 7.5 ALIGNMENT PROCEDURES

All testing on the Receiver Module is done with the module installed in the RF-505. However, printed circuit card assemblies are removed and installed during test.

**CAUTION**

*At front panel, set MODE switch at OFF whenever removing or installing assemblies.*

### 7.5.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Oscilloscope – Tektronix, Model 531

b. Ac vtvm – Hewlett-Packard, Model 300 E

c. Dc vom – Simpson, Model 260

d. Rf signal generator (hf) – Hewlett-Packard, Model 606B

e. Rf signal generator (vhf) – Hewlett-Packard, Model 608

f. Rf Vtvm – Boonton, Model 91H

g. 50 ohm probe termination for rf vtvm – Boonton, Model 91-8B

h. Frequency counter – Hewlett-Packard, Model 5245L

i. Headphones –

j. Card extender – RFC, P/N 724-0060

k. Adjusting tool – JFD, No. 5284

l. BNC "T" connector

m. BNC to miniature coax connector cable

n. BNC to clips cable

### 7.5.2 PRELIMINARY

a. Remove cover from Receiver Module.

b. With card extender, extend Front End Assembly 724-1100.

c. Remove protective covers from C16 and C23.

d. Disconnect P1002 (yellow) and P1004 (green) from Receiver Module.

e. At front panel, set MODE switch at USB.

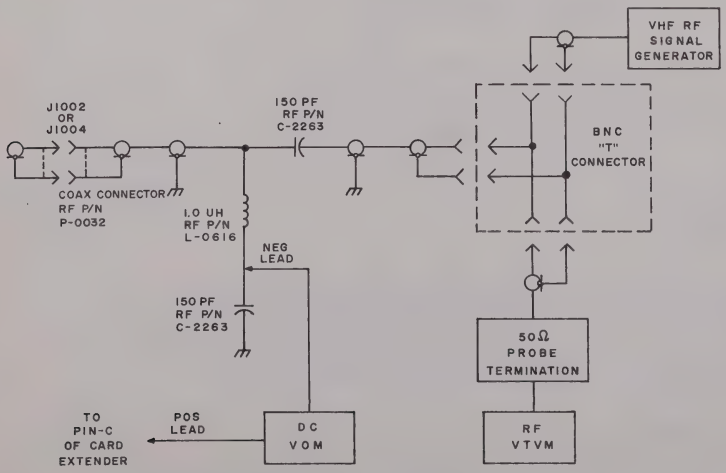



Figure 7.1 – Front End Assembly Test Set-Up

## 7.5.3 PROCEDURES

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | Connect the test equipment to the fabricated test circuit as shown in figure 7.1 and energize. Connect to coax connector on the test circuit to J1002 (yellow) on Receiver Module. | Calibrate (vhf) rf signal generator frequency to 170 MHz. Set output level at -20 dBm, cw. | |
| 2. | Same as step 1. | Set MODE switch at USB. Increase (vhf) rf signal generator output until dc vom indicates 1.7 volts. Adjust T1 on Front End Assembly for a peak indication while reducing rf generator output level to prevent vom indication from exceeding 1.7 volts. Record final output level of (vhf) rf signal generator when T1 is adjusted for a peak. | Less than -2 dBm. |
| 3. | Same as step 1. | Calibrate (vhf) rf signal generator at 157 MHz. Adjust output level until vom indicates 1.7 volts. Record output level of (vhf) rf signal generator. | Less than -2 dBm. |
| 4. | Same as step 1. | Calibrate (vhf) rf signal generator at 186 MHz. Adjust output level until vom indicates 1.7 volts. Record output level of (vhf) rf signal generator.<br><br>**NOTE**<br><br>*If the difference between the levels of steps 2, 3, and 4 are not within ±1 dB then set the rf signal generator at the frequency which provided the highest reading. Adjust T1 so that the correct reading is the average of the levels obtained in steps 3 and 4. Example:*<br><br>*Step 3 level -3 dBm*<br>*Step 4 level -5 dBm*<br><br>*Set rf signal generator to step 3 and set output to*<br><br>$\frac{(-3)+(-5)}{2} = -4\ dBm$<br><br>*and adjust T1 for exactly 1.75 volts.* | Less than -2 dBm and within ±1 dB of values recorded in steps 2 and 3. |
| 5. | Remove fabricated test circuit from J1002 (yellow) and connect it to J1004 (green) on Receiver Module. | Repeat steps 2, 3, and 4 adjusting T3 in step 2 instead of T1. | Same as steps 2, 3, and 4. |
| 6. | Remove the fabricated test circuit from J1004. Reconnect P1002 and P1004 to the Receiver Module. Connect rf vtvm to pin M of J1101 on Front End Assembly. Connect (hf) rf signal generator to J1, RF INPUT on rear panel of RF-505. | At the Receiver Module remove both Filter Assemblies, 724-1150 and 724-1175. Set MODE switch at LSB and FREQUENCY MHz switches at 14.0000 MHz, RF GAIN control fully clockwise. PRESELECTOR select switch at OUT. At (hf) rf signal generator set output to cw, 14.0 MHz at -40 dBm. Fine tune (hf) rf signal generator frequency for a peak indication on the rf vtvm. | |

## 7.5.3 PROCEDURES (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 6. (Cont.) | | **CAUTION**<br>*Do not set (hf) rf signal generator output level above +10 dBm while connected to J1. If a peak indication cannot be obtained with the rf vtvm at the 30 mVrms range switch range switch to next lower scale. Perform the following steps and return the rf vtvm to the 30 mVrms range as soon as possible without exceeding the +10 dBm input limit.* | |
| 7. | Same as step 6. | At Front End Assembly tune C23, C16, and C13 in order listed for maximum reading on rf vtvm while reducing (hf) rf signal generator output level so that rf vtvm reading does not exceed 30 mVrms. | |
| 8. | Same as step 6. | Repeat step 7 until no further improvement can be obtained in rf vtvm reading. | |
| 9. | Same as step 6. | Adjust (hf) rf signal generator output level until rf vtvm indicates 32 mVrms. | (Hf) rf signal generator output level should be less than -43 dBm. |
| 10. | Same as step 6. | Set (hf) rf signal generator output level at -40 dBm. Adjust R26 for an indication of 32 mVrms on the rf vtvm. | |
| 11. | Same as step 6. | Connect pin D to pin C of J1101 through a 220 ohm resistor. Increase (hf) rf signal generator output level to 0 dBm.<br>**CAUTION**<br>*Return (hf) rf signal generator output level to -40 dBm before removing resistor.* | Rf vtvm should read less than 10 mVrms. |
| 12. | At J1151 connect (hf) rf signal generator probe to pin V of 724-1150 assembly, ground probe to pin U. Connect frequency counter to uncalibrated output on rf signal generator. Connect oscilloscope and rf vtvm probes to pin A, ground probes to pin U of J1151. | Remove both Detector/Agc Assemblies and the 724-1100 Front End Assembly. Extend 724-1150 Usb/Am. Filter Assembly. Set rf signal generator to 500 kHz with enough output to read 25 mVrms on the rf vtvm. Tune T1 through T4 while reducing rf signal generator output so that rf vtvm reading never exceeds 30 mVrms. | Peak indication. |
| 13. | Same as step 12. | At front panel, check MODE switch for USB position. Set rf signal generator for 501 kHz, 10 uVrms cw input. | Output should be at least 20 mVrms. |
| 14. | Same as step 12. | At front panel, set MODE switch at AM. Set rf signal generator at 500 kHz, 80% 1 kHz modulation, 10 mVrms input. | No distortion on oscilloscope display. |
| 15. | Connect test equipment to 724-1175 assembly as in step 12. | Replace 724-1150 assembly and extend Lsb/Cw Filter Assembly. Perform same test procedure of steps 12 and 13 with rf signal generator, oscilloscope, and rf vtvm at J1176 pins instead of J1151. | |

## 7.5.3 PROCEDURES (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 16. | Same as step 12. | At front panel set MODE switch at LSB. Set rf signal generator for 499 kHz, 10 uVrms cw input. | Output should be at least 20 mVrms. |
| 17. | Same as step 12. | At front panel set MODE switch at CW. Sweep rf signal generator through passband. | Center frequency should be 501.0 kHz. Output should be at least 20 mVrms at this frequency. |
| 18. | At J1201 connect (hf) rf signal generator probe to pin A, ground probe to pin B. Connect oscilloscope probe to pin K, ground probe to pin B. Connect dc vom probe to TP2, ground probe to TP4. | At front panel set MODE switch at AM. Remove Usb/Am. Filter Assembly 724-1150. Extend Usb/Am. Detector/Agc Assembly. Set rf signal generator for 500 kHz, 30% 1kHz modulation. Adjust rf generator output until oscilloscope indicates 0.1 V peak-to-peak. Tune T1 for maximum output. | Input level should be less than 3 mVrms. |
| 19. | Disconnect oscilloscope probes. Connect oscilloscope and ac vtvm probes across pins V and T of J1201. | Set rf signal generator output at 3 mVrms. | Oscilloscope should display clean sine wave at 0.7 ±0.3 volts peak-to-peak. |
| 20. | Same as steps 18 and 19. | Exchange LSB/CW Detector/AGC Assembly for Usb/Am. Detector/Agc Assembly and repeat two preceeding steps, 19 and 20. | Same as steps 18 and 19. |
| 21. | Disconnect all test equipment. | Reinstall both Detector/Agc Assemblies. | |
| 22. | Connect (hf) rf signal generator to J1, RF INPUT, on back panel. | Extend Usb/Am. Filter Assembly, 724-1150. At front panel, set MODE switch at USB, FREQUENCY MHz switches at 4.0000 MHz, VOLUME control fully counterclockwise, RF GAIN fully clockwise, USB/AM Meter switch at AUDIO LEVEL. Set rf signal generator at 4.0 MHz cw at an output level of 5 uVrms. Adjust frequency for maximum indication on USB/AM. meter. | Peak indication on USB/AM. meter. |
| 23. | Same as step 22. | At front panel set USB/AM meter switch at SIGNAL STRENGTH. Adjust agc threshold control, R17, on Filter Assembly until USB/AM meter just begins to read up-scale. | Up-scale indication. |
| 24. | Same as step 22. Connect ac vtvm probe to pin K, ground probe to pin B. | Replace Filter Assembly. Extend USB/AM Detector/AGC Assembly. Reduce rf signal generator output level to 0. Note dB level on ac vtvm. Increase rf signal generator output level with ac vtvm reading increases by 10 dB. Vary frequency slightly to achieve maximum vtvm reading. | (Hf) rf signal generator output level should be less than 1 uVrms. |
| 25. | Same as step 22. | At front panel set MODE switch at AM. Set rf signal generator at 30% 1 kHz modulation at 0 uVrms. Note dB level on ac vtvm. Increase rf signal generator output level until ac vtvm reading increases by 10 dB. | (Hf) rf signal generator output level should be less than 4 uVrms. |
| 26. | Disconnect ac vtvm from pins K and B and connect to USB/AM AUDIO OUT terminals on TB1 on back panel. Connect oscilloscope probe to TP3 on Usb/Am. Detector/Agc Assembly, ground probe to TP4 (hf) rf signal generator same as previous step 22. | Set rf signal generator to 80% modulation at a 100 mVrms output level. Adjust delayed agc threshold control, R36, until flattening of modulation peaks just disappears. Advance volume control and check for audio output. | Modulation envelope should be approximately 0.6 V peak-to-peak. |
| 27. | Same as step 26. | At front panel, set USB/AM meter switch at AUDIO LEVEL. Adjust remote audio level control, R38, until ac vtvm reads 800 mVrms (0 dBm). | 800 mVrms on ac vtvm. |

## 7.5.3 PROCEDURES (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 28. | Same as step 26. | Replace Detector/Agc Assembly. Extend Lsb/Cw Filter Assembly. At front panel, set MODE switch at LSB, LSB/CW meter switch at AUDIO LEVEL. Set rf signal generator at an output level of 5 uVrms. Adjust frequency for maximum indication on LSB/CW meter. | Peak indication on LSB/CW meter. |
| 29. | Same as step 26. | At front panel, set LSB/CW meter switch at SIGNAL STRENGTH. Adjust agc threshold control, R17, until LSB/CW meter just begins to read up-scale. | LSB/CW meter indication just starts to increase. |
| 30. | Same as step 26. Connect ac vtvm probe to pin K, ground probe to pin B of J1201. | Replace Filter Assembly. Extend Lsb/Cw Detector/Agc Assembly. Reduce rf signal generator output level to 0. Note dB level on ac vtvm. Increase rf signal generator output level until ac vtvm reading increases by 10 dB. Vary frequency slightly to achieve maximum vtvm reading. | (Hf) rf signal generator output level should be less than 1 uVrms. |
| 31. | Disconnect ac vtvm from pins K and B and connect to LSB/CW AUDIO OUT terminals on TB1 on back panel. Connect oscilloscope probe to TP3 on Lsb/Cw Detector/Agc Assembly, ground probe to TP4. (Hf) rf signal generator same as previous step 22. | Set rf signal generator to 80% 400 Hz modulation at 100 mVrms output level. Adjust delayed agc threshold control, R36, until flattening of modulation peaks just disappears. Advance volume control and check for audio output. | Modulation envelopes should be approximately 0.6 V peak-to-peak. |
| 32. | Same as step 31. | At front panel set LSB/CW meter switch at AUDIO LEVEL. Adjust remote audio level control, R38, until ac vtvm reads 800 mVrms (0 dBm). | 800 mVrms on ac vtvm. |
| | | **NOTE**<br>*The tests in steps 33 and 34 are only to be performed if the receiver is equipped with the optional cw filter.* | |
| 33. | Disconnect all test equipment except (hf) rf signal generator. | At front panel set MODE switch CW. Set rf signal generator for cw operation at 50 uVrms output. Advance volume control and adjust rf signal generator frequency to check for presence of narrow cw filter response. | |
| 34. | Same as step 33. | At front panel, set MODE switch at USB. Adjust rf signal generator frequency to produce audible beat note in speaker. Adjust SQUELCH control until note just mutes. Increase rf signal generator output level to 100 mVrms. | Receiver should unsquelch. |

## 7.6 CIRCUIT DIAGRAMS AND PARTS LISTS

**NOTE**

*The parts lists of the assemblies are located on the back of the circuit diagrams.*

# NOTES

NOTES:
1. ALL DIODES IN4454
2. LAST REFERENCE DESIGNATORS:
   CR4
   C4
   L2

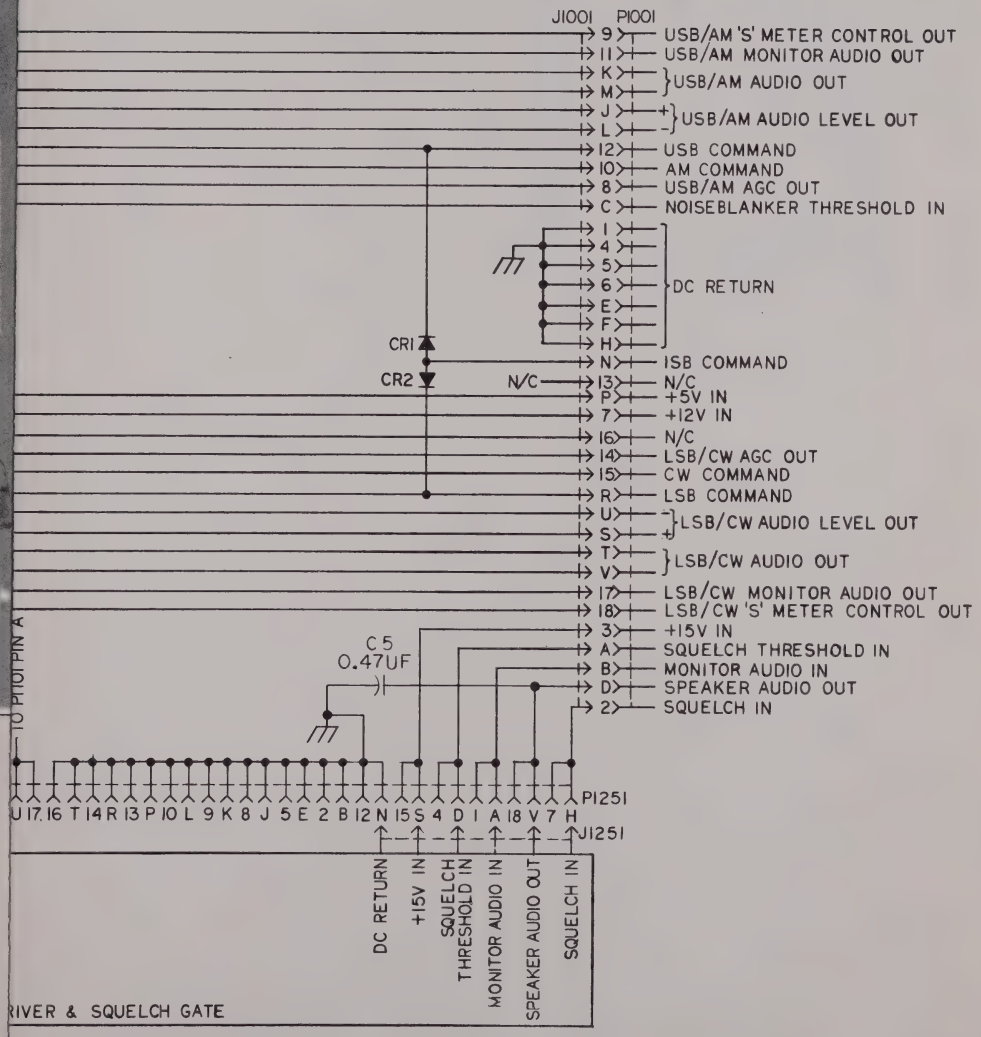
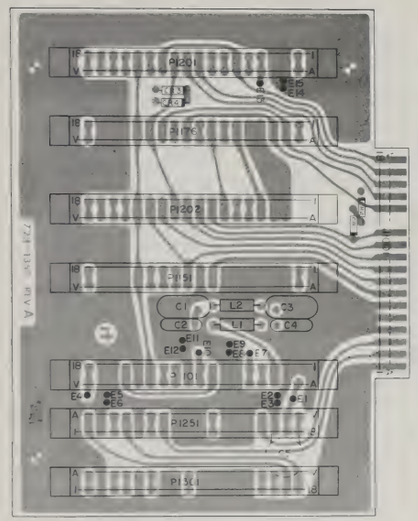
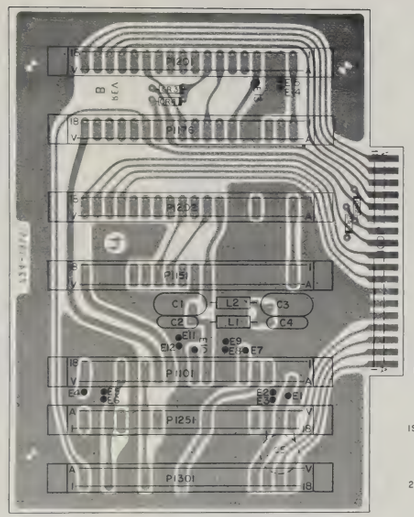



Figure 7.2 — Receiver Module Circuit Diagram



B. Component Locations with Adjacent Side Foil



A. Component Locations with Opposite Side Foil

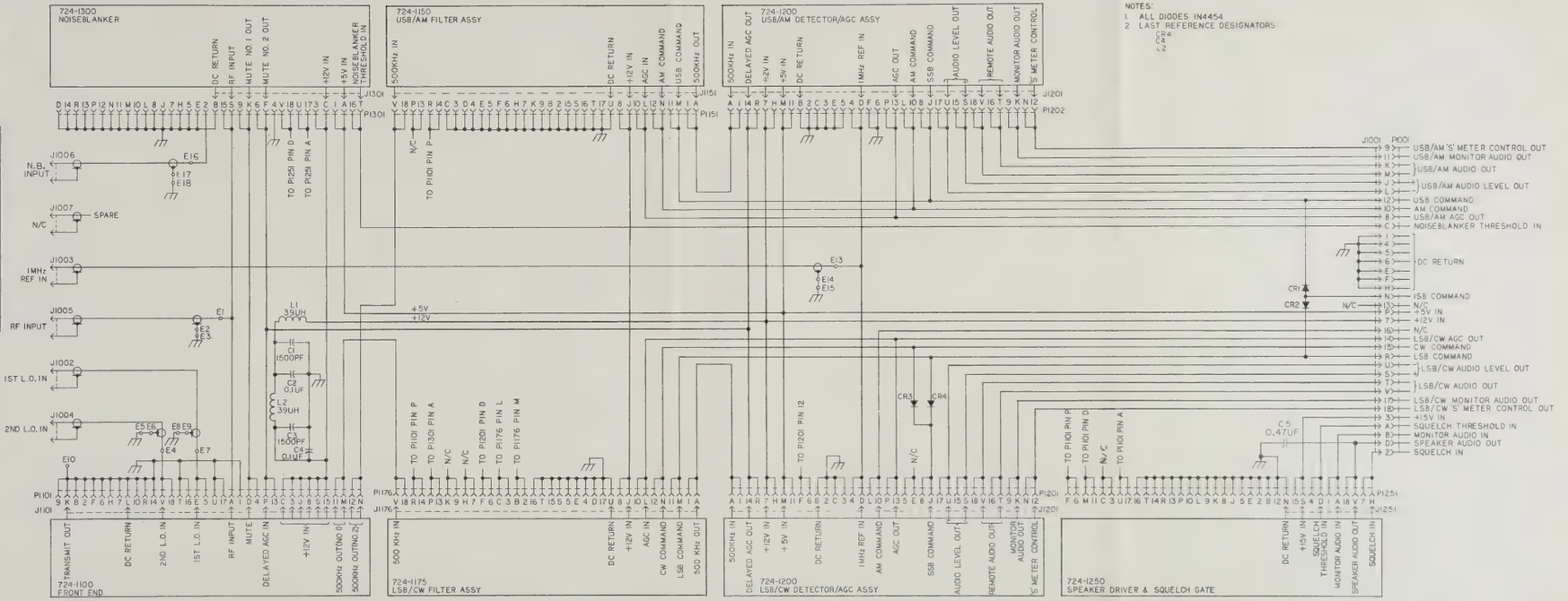
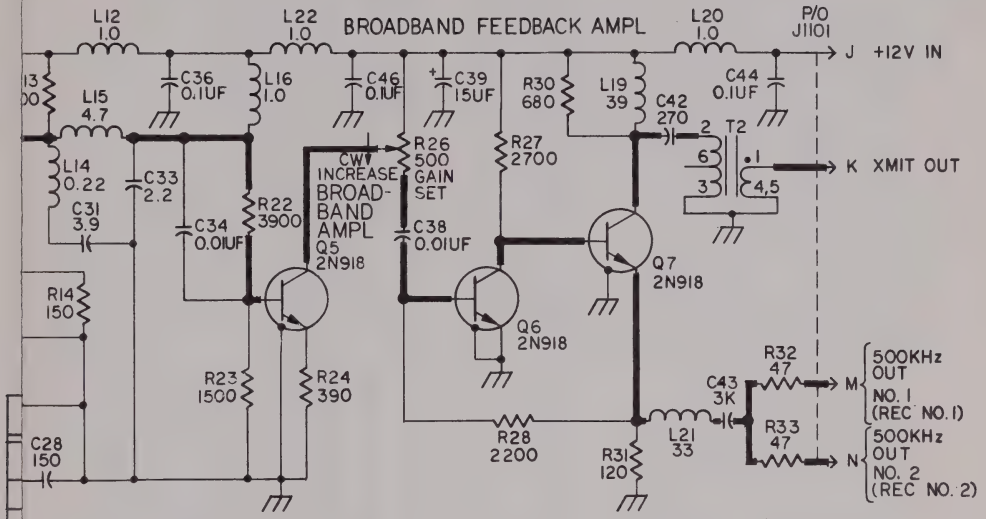



Figure 7.2 — Receiver Module Circuit Diagram

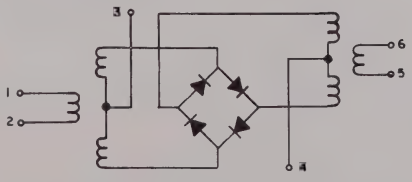



NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, ALL CAPACITANCES ARE IN PICOFARADS, ALL INDUCTANCES ARE IN MICROHENRYS
2. ➡ DENOTES RF SIGNAL FLOW
3. FL1: Fc=156.000000 MHz
4. L5,L6,L10 CONSTRUCTED WITH ENAMEL CLOSEWOUND SEALED WITH "Q" DOPE PER TABLE:

| COIL | WIRE GA. | NO. TURNS | I. D. |
|---|---|---|---|
| L5 | 24 | 7 | 0.100 |
| L6 | 20 | 6 1/2 | 0.200 |
| L10 | | 8 1/2 | |

5. CIRCUIT DIAGRAM FOR A1:




FIRST LETTER OF MANUFACTURER'S NAME DENOTES INPUT END

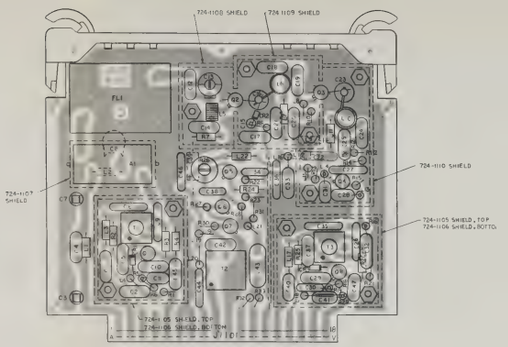
6. LAST DESIGNATORS:
   R34
   C47
   Q8
   CR3
7. RED DOT DENOTES INPUT END

Figure 7.3 – Front End Assembly Circuit Diagram

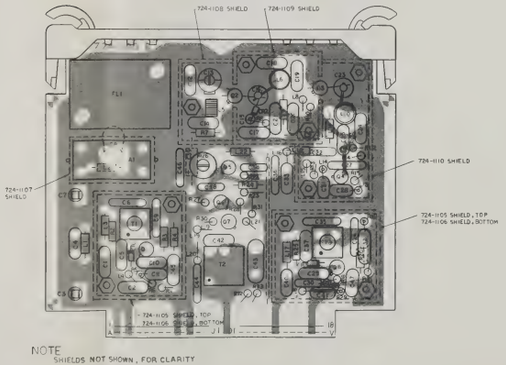
DC VOLTAGES*

| Stage | E | B | C | |
|---|---|---|---|---|
| Q1 | 4.80 | 5.60 | 12.0 | |
| Q5 | 1.60 | 2.40 | 7.80 | |
| Q6 | 0.00 | 0.75 | 1.55 | |
| Q7 | 0.79 | 1.55 | 10.0 | |
| Q8 | 5.10 | 5.90 | 12.0 | |
| | Gate | Source | Drain | |
| Q2 | 0 | 2.30 | 8.90 | |
| Q3 | 0 | 1.90 | 8.90 | |
| | Drain 1 | Gate 2 | Gate 3 | Source 4 |
| Q4 | 5.50 | 2.50 | 0.96 | 1.10 |

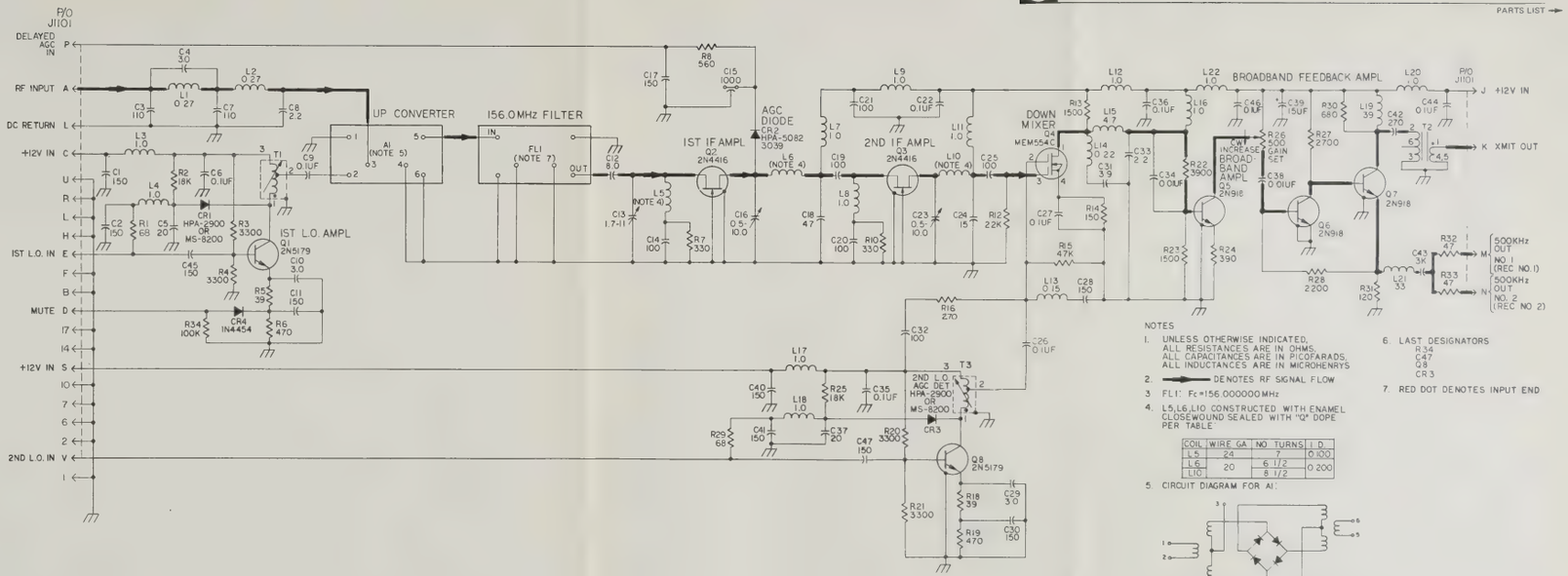
*Referenced to ground.




A. Component Locations with Opposite Side Foil




B. Component Locations with Adjacent Side Foil




NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, ALL CAPACITANCES ARE IN PICOFARADS, ALL INDUCTANCES ARE IN MICROHENRYS
2. ——▶ DENOTES RF SIGNAL FLOW
3. FL1: Fc=156.000000 MHz
4. L5,L6,L10 CONSTRUCTED WITH ENAMEL CLOSEWOUND SEALED WITH "Q" DOPE PER TABLE

| COIL | WIRE GA | NO TURNS | I D |
|---|---|---|---|
| L5 | 24 | 7 | 0.100 |
| L6 | 20 | 6 1/2 | 0.200 |
| L10 | | 8 1/2 | |

5. CIRCUIT DIAGRAM FOR A1:



FIRST LETTER OF MANUFACTURER'S NAME DENOTES INPUT END

6. LAST DESIGNATORS
   R34
   C47
   Q8
   CR3
7. RED DOT DENOTES INPUT END

Figure 7.3 – Front End Assembly Circuit Diagram

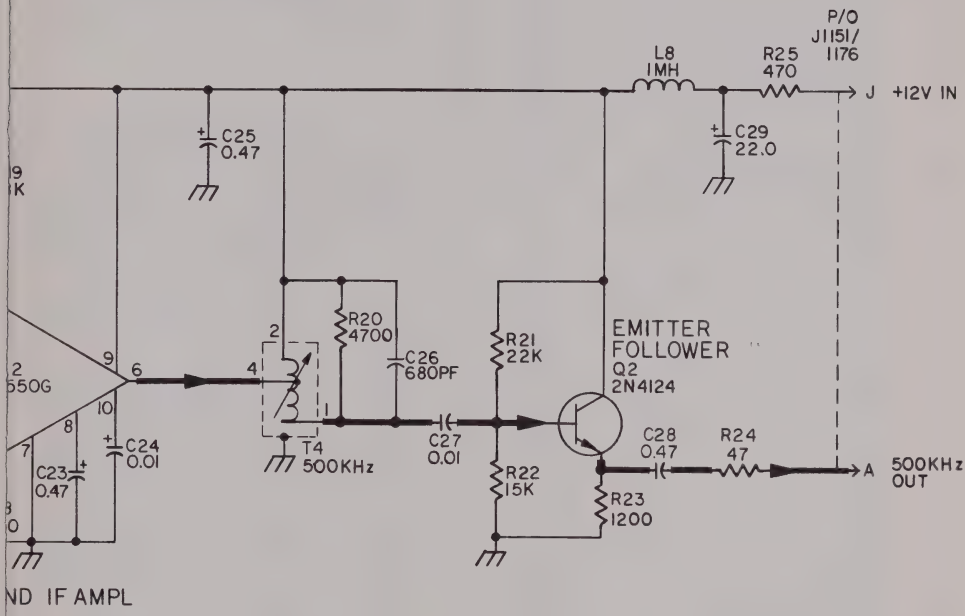
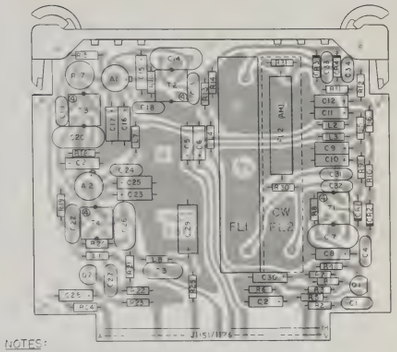
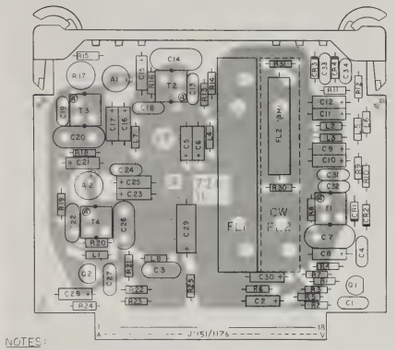



Figure 7.4 — Filter Assembly Circuit Diagram



NOTES:
1. AM FILTER, R30 & R31 USED ONLY ON 724-1150 ASSY.
2. CW FILTER USED ONLY ON 724-1175 ASSY.

A. Component Locations with Opposite Side Foil



NOTES:
1. AM FILTER, R30 & R31 USED ONLY ON 724-1150 ASSY.
2. CW FILTER USED ONLY ON 724-1175 ASSY.

B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

| Stage | E | B | C | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Q1 | 0.83 | 1.50 | 4.70 | | | | | | | |
| Q2 | 2.10 | 2.80 | 7.30 | | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 |
| A1 | 1.50 | 0.75 | 0.75 | 1.50 | 4.00 | 6.00 | 0.00 | 4.00 | 6.70 | 4.00 |
| A2 | 1.50 | 0.75 | 0.75 | 1.50 | 4.00 | 7.00 | 0.00 | 4.00 | 7.00 | 4.00 |

*Referenced to ground.

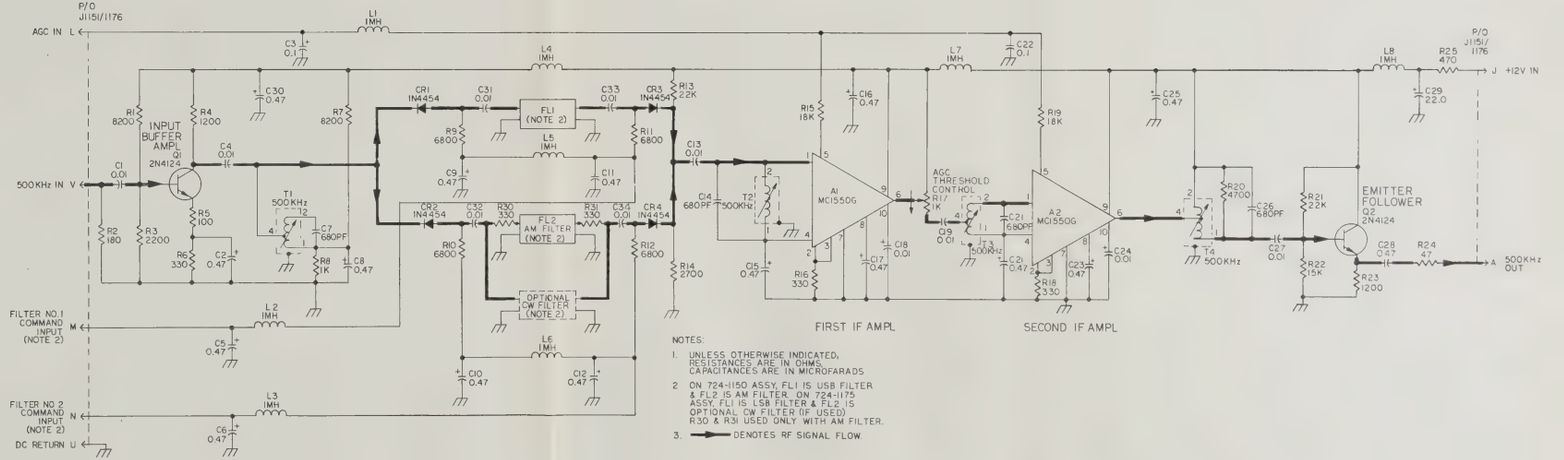

P/O J1151/1176
AGC IN L
500KHz IN V
FILTER NO.1 COMMAND INPUT (NOTE 2) M
FILTER NO.2 COMMAND INPUT (NOTE 2) N
DC RETURN U
INPUT BUFFER AMPL
FL1 (NOTE 2)
FL2 AM FILTER (NOTE 2)
OPTIONAL CW FILTER (NOTE 2)
AGC THRESHOLD CONTROL
EMITTER FOLLOWER
FIRST IF AMPL
SECOND IF AMPL
+12V IN J
500KHz OUT A
NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS.
2. ON 724-1150 ASSY, FL1 IS USB FILTER & FL2 IS AM FILTER. ON 724-1175 ASSY, FL1 IS LSB FILTER & FL2 IS OPTIONAL CW FILTER (IF USED) R30 & R31 USED ONLY WITH AM FILTER.
3. DENOTES RF SIGNAL FLOW.

Figure 7.4 — Filter Assembly Circuit Diagram

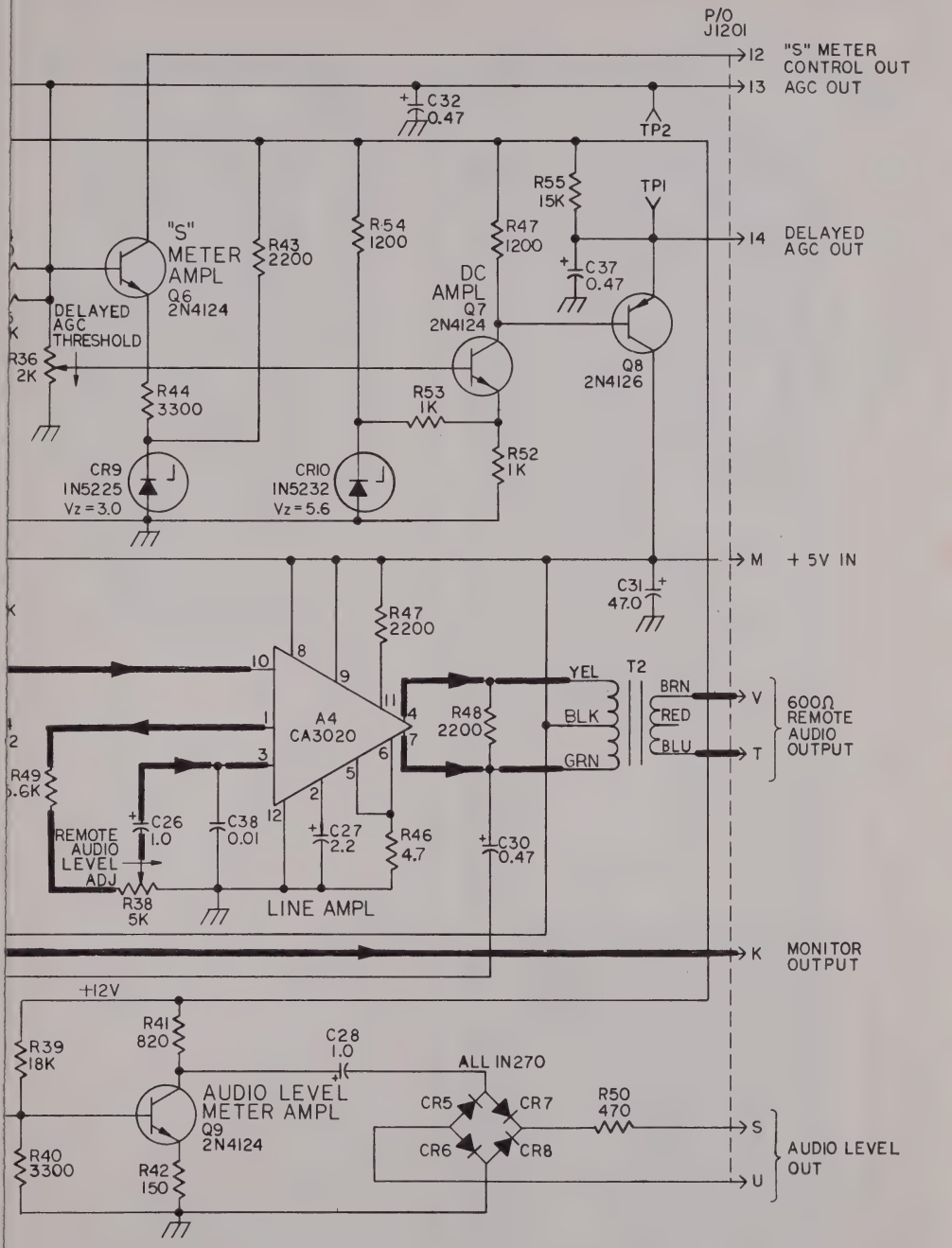



Figure 7.5 — Detector/Agc Assembly Circuit Diagram

## USB/AM FILTER ASSEMBLY – 724-1150

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A2 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| C1 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C2 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C3 | Capacitor, Ceramic, Disk, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C5 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C6 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C7 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C8 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C9 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C10 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C11 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C12 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C13 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C14 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C15 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C16 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C17 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C18 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C19 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C20 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C21 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C22 | Capacitor, Ceramic Disk, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C23 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C24 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C25 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C26 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C27 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C28 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C29 | Capacitor, Tantalum, 22 UF ±20%; 15 Vdcw | C-6353 |
| C30 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C31 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C32 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C33 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C34 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| FL1 | Filter, Mechanical, 500 KHz, USB | 724-1160 |
| FL2 | Filter, Ceramic, 500 KHz, AM | 724-1161 |
| L1 | Coil, Rf, 1 UH | L-0652 |
| L2 | Coil, Rf, 1 UH | L-0652 |
| L3 | Coil, Rf, 1 UH | L-0652 |
| L4 | Coil, Rf, 1 UH | L-0652 |
| L5 | Coil, Rf, 1 UH | L-0652 |
| L6 | Coil, Rf, 1 UH | L-0652 |
| L7 | Coil, Rf, 1 UH | L-0652 |
| L8 | Coil, Rf, 1 UH | L-0652 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon, 8200 ohms ±10%; 1/4W | R-0035 |
| R2 | Resistor, Carbon, 180 ohms ±10%; 1/4W | R-0015 |
| R3 | Resistor, Carbon, 2200 ohms ±10%; 1/4W | R-0028 |
| R4 | Resistor, Carbon, 1200 ohms ±10%; 1/4W | R-0025 |
| R5 | Resistor, Carbon, 100 ohms ±10%; 1/4W | R-0012 |
| R6 | Resistor, Carbon, 330 ohms ±10%; 1/4W | R-0018 |
| R7 | Resistor, Carbon, 8200 ohms ±10%; 1/4W | R-0035 |
| R8 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R9 | Resistor, Carbon, 6800 ohms ±10%; 1/4W | R-0034 |
| R10 | Resistor, Carbon, 6800 ohms ±10%; 1/4W | R-0034 |
| R11 | Resistor, Carbon, 6800 ohms ±10%; 1/4W | R-0034 |
| R12 | Resistor, Carbon, 6800 ohms ±10%; 1/4W | R-0034 |
| R13 | Resistor, Carbon, 22K ±10%; 1/4W | R-0040 |
| R14 | Resistor, Carbon, 2700 ohms ±10%; 1/4W | R-0029 |
| R15 | Resistor, Carbon, 18K ±10%; 1/4W | R-0039 |
| R16 | Resistor, Carbon, 330 ohms ±10%; 1/4W | R-0018 |
| R17 | Resistor, Variable, 1K ±10%; 1/2W | R-7210 |
| R18 | Resistor, Carbon, 330 ohms ±10%; 1/4W | R-0018 |
| R19 | Resistor, Carbon, 18K ±10%; 1/4W | R-0039 |
| R20 | Resistor, Carbon 4700 ohms ±10%; 1/4W | R-0032 |

## USB/AM FILTER ASSEMBLY – 724-1150 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| R21 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R22 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| R23 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R24 | Resistor, Carbon; 47 ohms ±10%; 1/4W | R-0008 |
| R25 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R30 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R31 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| T1 | Transformer, Interstage, Variable, 500 KHz | 724-1162 |
| T2 | Transformer, Interstage, Variable, 500 KHz | 724-1162 |
| T3 | Transformer, Interstage, Variable, 500 KHz | 724-1162 |
| T4 | Transformer, Interstage, Variable, 500 KHz | 724-1162 |
| — | Ejector, P.C. Board | MP-4341 |

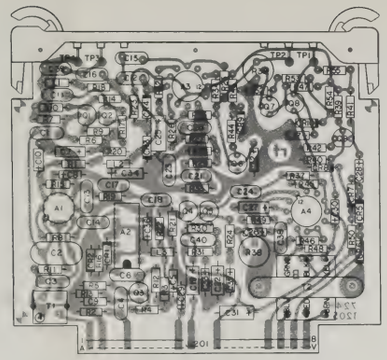
## LSB/CW FILTER ASSEMBLY – 724-1175

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A2 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| C1 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C2 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C3 | Capacitor, Ceramic, Disk, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C5 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C6 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C7 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C8 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C9 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C10 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C11 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C12 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C13 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C14 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C15 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C16 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C17 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C18 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C19 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C20 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C21 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C22 | Capacitor, Ceramic, Disk, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C23 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C24 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C25 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C26 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C27 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C28 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C29 | Capacitor, Tantalum, 22 UF ±20%; 15 Vdcw | C-6353 |
| C30 | Capacitor, Tantalum, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C31 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C32 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C33 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C34 | Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| FL1 | Filter, Mechanical, 500 kHz, LSB | 724-1185 |
| *FL2 | Filter, Mechanical, 500 kHz, CW | 724-1186 |
| L1 | Coil, Rf, 1 UH | L-0652 |
| L2 | Coil, Rf, 1 UH | L-0652 |
| L3 | Coil, Rf, 1 UH | L-0652 |
| L4 | Coil, Rf, 1 UH | L-0652 |

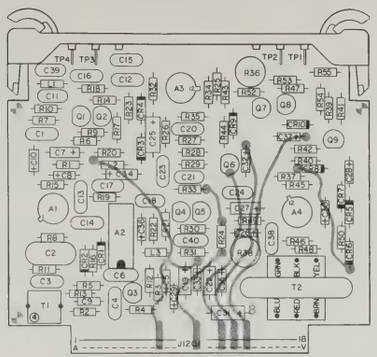
*Optional

## LSB/CW FILTER ASSEMBLY – 724-1175 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| L5 | Coil, Rf, 1 UH | L-0652 |
| L6 | Coil, Rf, 1 UH | L-0652 |
| L7 | Coil, Rf, 1 UH | L-0652 |
| L8 | Coil, Rf, 1 UH | L-0652 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 8200 ohms ±10%; 1/4W | R-0035 |
| R2 | Resistor, Carbon; 180 ohms ±10%; 1/4W | R-0015 |
| R3 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R4 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R5 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R6 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R7 | Resistor, Carbon; 8200 ohms ±10%; 1/4W | R-0035 |
| R8 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R9 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R10 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R11 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R12 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R13 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R14 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R15 | Resistor, Carbon; 18K ±10%; 1/4W | R-0039 |
| R16 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R17 | Resistor, Variable, 1K ±10%; 1/2W | R-7210 |
| R18 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R19 | Resistor, Carbon; 18K ±10%; 1/4W | R-0039 |
| R20 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R21 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R22 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| R23 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R24 | Resistor, Carbon; 47 ohms ±10%; 1/4W | R-0008 |
| R25 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R30 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R31 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| T1 | Transformer, Interstage, Variable, 500 kHz | 724-1162 |
| T2 | Transformer, Interstage, Variable, 500 kHz | 724-1162 |
| T3 | Transformer, Interstage, Variable, 500 kHz | 724-1162 |
| T4 | Transformer, Interstage, Variable, 500 kHz | 724-1162 |
| — | Ejector, P.C. Board | MP-4341 |



A. Component Locations with Opposite Side Foil



B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

| Stage | E | B | C | MODE Switch Position |
|---|---|---|---|---|
| Q1 | 0.53 | 1.20 | 8.40 | |
| Q2 | 9.00 | 8.40 | 4.10 | |
| Q3 | 0.87 | 1.50 | 4.30 | |
| Q4 | 0.91 | 1.55 | 3.00 | USB |
| Q4 | 0.65 | 0.00 | 3.75 | AM |
| Q5 | 0.91 | 0.00 | 3.00 | USB |
| Q5 | 0.65 | 1.30 | 3.75 | AM |
| Q6 | 2.45 | 1.70 | 12.4 | |
| Q7 | 2.55 | 1.50 | 11.0 | |
| Q8 | 11.0 | 11.0 | 5.40 | |
| Q9 | 1.05 | 1.70 | 5.40 | |

| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 | Pin 11 | Pin 12 | Pin 13 | Pin 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1.75 | 1.00 | 1.00 | 1.75 | 6.00 | 9.80 | 0.00 | 6.20 | 11.0 | 6.0 | — | — | — | — |
| A2 | 0.00 | 5.00 | 5.00 | 5.00 | 5.00 | 0.00 | 0.00 | 6.40 | 5.00 | 5.00 | 5.00 | 7.60 | 5.00 | 5.00 |
| A3 | 1.75 | 2.00 | 1.00 | 1.25 | 12.0 | 0.75 | 1.50 | 12.0 | 1.25 | 0.00 | 12.0 | 12.0 | — | — |
| A4 | 0.00 | 3.20 | 1.00 | 1.00 | 5.00 | 0.00 | 0.00 | 5.00 | 5.00 | 5.00 | 0.50 | 2.25 | — | — |

*Referenced to ground.



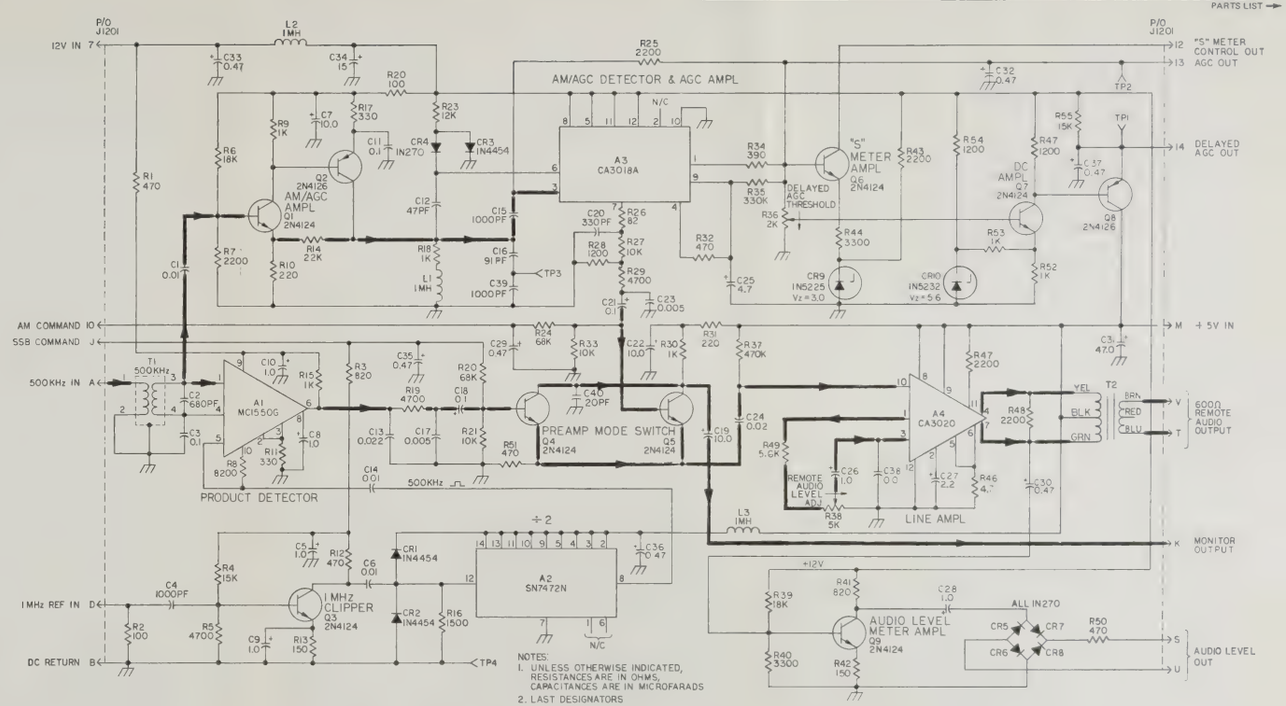



Figure 7.5 — Detector/Agc Assembly Circuit Diagram

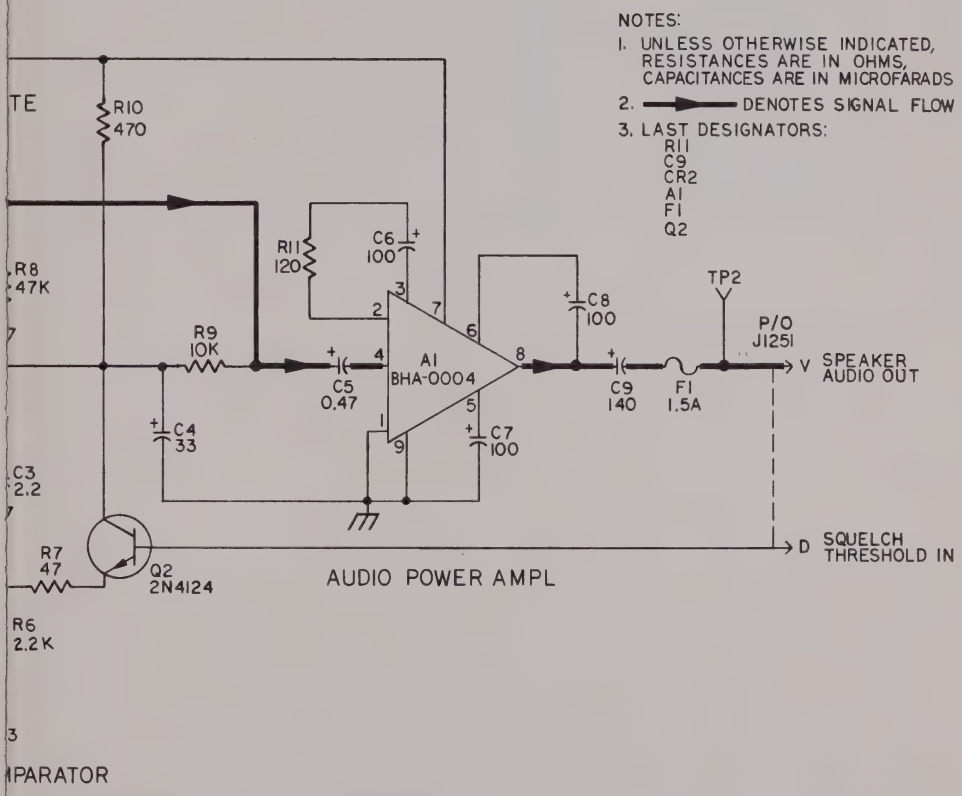


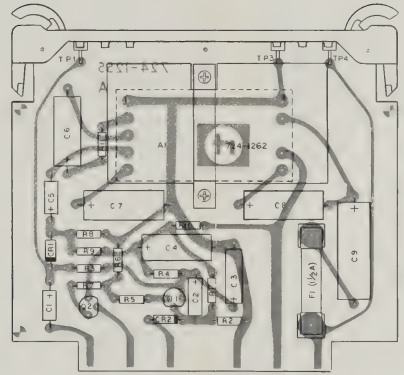

Figure 7.6 — Speaker Driver and Squelch Gate Assembly Circuit Diagram

## DETECTOR/AGC ASSEMBLY – 724-1200

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A2 | Integrated Circuit, Flip Flop, Type 5N7472N | IC-0016 |
| A3 | Integrated Circuit, Transistor Array, Type CA3018 | IC-0035 |
| A4 | Integrated Circuit, Audio Amplifier, Type CA3020 | IC-0037 |
| C1 | Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C2 | Capacitor, Mica, 680 PF ±5%; 500 Vdcw | C-0148 |
| C3 | Capacitor, Ceramic, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C4 | Capacitor, Ceramic, 0.001 UF; 500 Vdcw | C-0001 |
| C5 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C6 | Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C7 | Capacitor, Tantalum, Polar, 10 UF ±20%; 2 Vdcw | C-6327 |
| C8 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C9 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C10 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C11 | Capacitor, Ceramic, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C12 | Capacitor, Mica, 47 PF ±5%; 500 Vdcw | C-0117 |
| C13 | Capacitor, Ceramic, 0.02 UF +100% -20%; 30 Vdcw | C-0059 |
| C14 | Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C15 | Capacitor, Ceramic, 0.001 UF; 500 Vdcw | C-0001 |
| C16 | Capacitor, Mica, 91 PF ±5%; 500 Vdcw | C-0125 |
| C17 | Capacitor, Ceramic, 0.005 UF +60% -40%; 150 Vdcw | C-0064 |
| C18 | Capacitor, Ceramic, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C19 | Capacitor, Tantalum, Polar, 10 UF ±20%; 20 Vdcw | C-6327 |
| C20 | Capacitor, Mica, 330 PF ±5%; 500 Vdcw | C-0139 |
| C21 | Capacitor, Ceramic, 0.1 UF +100% -20%; 30 Vdcw | C-0061 |
| C22 | Capacitor, Tantalum, Polar, 10 UF ±20%; 20 Vdcw | C-6327 |
| C23 | Capacitor, Ceramic, 0.005 UF +60% -40%; 150 Vdcw | C-0064 |
| C24 | Capacitor, Ceramic, 0.02 UF +100% -20%; 30 Vdcw | C-0059 |
| C25 | Capacitor, Tantalum, Polar, 4.7 UF ±20%; 35 Vdcw | C-6345 |
| C26 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C27 | Capacitor, Tantalum, Polar, 2.2 UF ±20%; 35 Vdcw | C-6303 |
| C28 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C29 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C30 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C31 | Capacitor, Tantalum, Polar, 47 UF ±20%; 6 Vdcw | C-6357 |
| C32 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C33 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C34 | Capacitor, Tantalum, Polar, 22 UF ±20%; 15 Vdcw | C-6353 |
| C35 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C36 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C37 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C38 | Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw | C-0065 |
| C39 | Capacitor, Ceramic, 0.001 UF; 500 Vdcw | C-0001 |
| C40 | Capacitor, Mica, 20 PF ±5%; 500 Vdcw | C-0108 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N270 | CR-0047 |
| CR5 | Diode, Silicon, Type 1N270 | CR-0047 |
| CR6 | Diode, Silicon, Type 1N270 | CR-0047 |
| CR7 | Diode, Silicon, Type 1N270 | CR-0047 |
| CR8 | Diode, Silicon, Type 1N270 | CR-0047 |
| CR9 | Diode, Zener 3.0 Vdc ±10%, Type 1N5225 | CR-0204 |
| CR10 | Diode, Zener 5.6 Vdc ±10%, Type 1N5232 | CR-0211 |
| L1 | Coil, Rf, 1 UH | L-0652 |
| L2 | Coil, Rf, 1 UH | L-0652 |
| L3 | Coil, Rf, 1 UH | L-0652 |
| Q1 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, PNP, 2N4126 | Q-0386 |
| Q3 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| Q4 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| Q5 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| Q6 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| Q7 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| Q8 | Transistor, Silicon, General Purpose, PNP, 2N4126 | Q-0386 |
| Q9 | Transistor, Silicon, General Purpose, NPN, 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R2 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R3 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R4 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| R5 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R6 | Resistor, Carbon; 18K ±10%; 1/4W | R-0039 |
| R7 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R8 | Resistor, Carbon; 8200 ohms ±10%; 1/4W | R-0035 |
| R9 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R10 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R11 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R12 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R13 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R14 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R15 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R16 | Resistor, Carbon; 1500 ohms ±10%; 1/4W | R-0026 |
| R17 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R18 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R19 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R20 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R21 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |

## DETECTOR/AGC ASSEMBLY – 724-1200 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| R22 | Resistor, Carbon; 68K ±10%; 1/4W | R-0046 |
| R23 | Resistor, Carbon; 12K ±10%; 1/4W | R-0037 |
| R24 | Resistor, Carbon; 68K ±10%; 1/4W | R-0046 |
| R25 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R26 | Resistor, Carbon; 82 ohms ±10%; 1/4W | R-0011 |
| R27 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R28 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R29 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R30 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R31 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R32 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R33 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R34 | Resistor, Carbon; 390 ohms ±10%; 1/4W | R-0019 |
| R35 | Resistor, Carbon; 330K ±10%; 1/4W | R-0054 |
| R36 | Resistor, Variable, Single turn; 2K 10%; 1/2W | R-7212 |
| R37 | Resistor, Carbon; 470K ±5%; 1/4W | R-1313 |
| R38 | Resistor, Variable, Single turn, 5K 10%; 1/2W | R-7216 |
| R39 | Resistor, Carbon; 18K ±10%; 1/4W | R-0039 |
| R40 | Resistor, Carbon; 3300 ohms ±10%; 1/4W | R-0030 |
| R41 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R42 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R43 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R44 | Resistor, Carbon; 3300 ohms ±10%; 1/4W | R-0030 |
| R45 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R46 | Resistor, Composition; 4700 ohms ±5%; 1/4W | R-0856 |
| R47 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R48 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R49 | Resistor, Carbon; 5600 ohms ±15%; 1/4W | R-0033 |
| R50 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R51 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R52 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R53 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R54 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R55 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| T1 | Transformer, Variable, 500 kHz | 724-1210 |
| T2 | Transformer, Audio, 150 ohms C.T. to 500 ohms C.T. | 724-1211 |
| — | Ejector, P.C. Board, with jacks | MP-4340 |




Component Locations with Opposite Side Foil

SPEAKER DRIVER

DC VOLTAGES*

| Stage | E | B | C | Squelch Knob Position | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Q1 | 2.10 | 2.75 | 7.00 | Fully cw | | | | | |
| Q1 | 6.50 | 2.60 | 13.0 | Fully ccw | | | | | |
| Q2 | 2.05 | 2.15 | 13.8 | Fully cw | | | | | |
| Q2 | 6.70 | 7.30 | 12.9 | Fully ccw | | | | | |
| | Cathode | Anode | | | | | | | |
| CR1 | 8.80 | 9.30 | | Fully cw | | | | | |
| CR1 | 13.0 | 10.6 | | Fully ccw | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 |
| A1 | 0.00 | 5.40 | 0.00 | 4.40 | 8.50 | 12.0 | 15.0 | 6.60 | 0.00 |

*Referenced to ground.

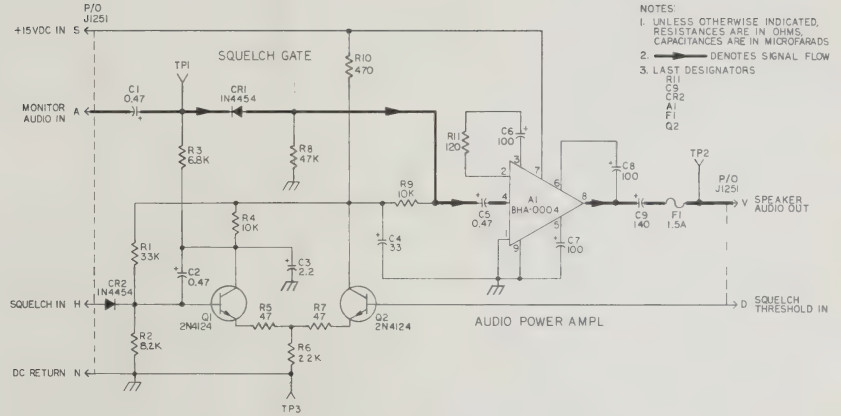



Figure 7.6 – Speaker Driver and Squelch Gate Assembly Circuit Diagram

# CHAPTER 8
# SYNTHESIZER MODULE

## 8.1 GENERAL

This chapter contains the detailed theory of operation of each assembly in the Synthesizer Module. Also included are the necessary alignment and troubleshooting procedures to maintain the module and assemblies to specified performance. Circuit diagrams and parts list of the Synthesizer Module and assemblies are included.

## 8.2 DETAILED THEORY OF OPERATION

The theory of operation of each of the assemblies in the Synthesizer Module is presented in the following paragraphs. Refer to chapter 4 for the general overall theory of the Synthesizer Module.

### 8.2.1 SPECTRUM GENERATOR ASSEMBLY (724-0750)

Spectrum Generator Assembly 724-0750 consists of a pulse generator, three band-pass filters, a series of four decade dividers, an input amplifier, and four output amplifiers. Output signals from the Spectrum Generator Assembly are applied to the various assemblies of the Synthesizer Module and to the Receiver Module. The output to the Receiver Module is the 1 MHz local oscillator number three injection signal. The remaining signals are:

a. 20 MHz for Translator Assembly.

b. 15 MHz for 14 MHz Up-Mixer and VFO Assembly.

c. 12 MHz for HF VCO Assembly.

d. 500 kHz for Second L.O. Assembly.

e. 25 kHz for VHF Divider Assembly.

f. 1 kHz for HF Divider Assembly.

The 5 MHz input from the Frequency Standard Module is amplified by A1, filtered by L1, and applied to NAND gate A2-C. Diodes CR1 and CR2 at the input of A1 clip the input signal to prevent saturation of the amplifier. From A1 the 5 MHz signal is squared by NAND gate A2-C and applied to one-shot pulse generator A2-A, A2-B, and A2-C and to decade divider A3. The one-shot pulse generator circuitry provides a 5 MHz pulse output signal to the 20 MHz and 15 MHz band-pass filters.

The 20 MHz band-pass filter extracts the fourth harmonic, 20 MHz, which is amplified by A8 and applied to pins V and 18 of J0751 for the Translator Assembly.

The 15 MHz band-pass filter extracts the third harmonic from the 5 MHz pulse. This signal is then amplified by A10 and applied to pins S and 15 of J0751 for the 14 MHz Up-Mixer and VFO Assembly.

The 5 MHz pulse from A2-C is applied to decade divider A3 where it is divided by five to provide a 1 MHz signal. This signal is shaped and amplified by Q3 and Q4, connected in a push-pull configuration, and applied to pins E and 5 of J0751 as a 1 MHz sine wave.

The 1 MHz output of A3 is also applied to the 12 MHz band-pass filter where the twelfth harmonic is selected. The 12 MHz signal is then progressively amplified by A9 and Q1 and Q2. Transistor Q1 and Q2 are connected in a push-pull configuration with the output coupled by C45 to pins K and 9 of J0751.

At decade dividers A3, A4, A5, and A6, the 1 MHz signal is progressively divided to provide the 500 kHz, 25 kHz, and 1 kHz output signals. These signals are coupled by NAND gates A7-A, A7-13, and A7-C to the corresponding pins on connector J0751.

### 8.2.2 SECOND L.O. GENERATOR ASSEMBLY (724-0800)

The Receiver Module second local oscillator injection signal, 156.5 MHz, is provided by Second L.O. Generator Assembly 724-0800 in the Synthesizer Module. Basically the assembly consists of a 19.5625 MHz voltage controlled crystal oscillator (VCXO) circuit which is multiplied by eight to produce the required 156.5 MHz output signal. To maintain frequency accuracy, the output of the VCXO is mixed with a 160 MHz reference signal to provide a 3.5 MHz difference. This signal is then compared with a second 3.5 MHz reference signal in a phase detector. If the VCXO is off frequency then the error will be detected by the phase detector and applied as a dc feedback voltage to the VCXO. The two reference signals (160 MHz and 3.5 MHz) are derived directly from the 5 MHz frequency standard in the Spectrum Generator Assembly, and are therefore coherent with the frequency standard. The first reference signal is the 20 MHz output signal amplified and multiplied by eight in the Translator Assembly to provide the 160 MHz mixing signal. The second reference signal is the 500 kHz signal from the Spectrum Generator Assembly multiplied by seven, in the Second L.O. Generator Assembly, to provide the 3.5 MHz reference signal for the phase detector.

The VCXO is a dual emitter – coupled crystal oscillator, Q1 and Q2, with a fundamental frequency of 19.5625 MHz. Small adjustment of the crystal frequency is accomplished by the dc feedback voltage (error signal) which is applied to varactor diodes CR1 and CR2. Initial amplification of the VCXO is accomplished by Q3. Capacitor C18 couples the output of Q3 to the input of the pulse generator circuitry.

The pulse generator circuitry, NAND gates A3-A through A3-C, provide a pulse output signal at the frequency of the VCXO to the times eight multiplier circuit. Inductor L10 and capacitor C30 provide a series tuned circuit at 156.5 MHz to provide initial filtering of the eight harmonic of the VCXO. The signal is further filtered by the 156.5 MHz tuned filter at the input of output amplifier Q5. Capacitor C28 couples the 156.5 MHz signal at C30 to the input of 156.5 MHz buffer amplifier A4.

Output amplifier Q5 provides the final amplification of the 156.5 MHz signal which is coupled to pin V of J0801 by C55 as the 156.5 MHz second local oscillator injection signal. Agc amplifier Q6 and Q7 provide gain control of the output signal.

The 156.5 MHz signal at A4 is amplified and applied to MOSFET mixer Q4. Also applied to Q4 is the 160 MHz reference signal from the Translator Assembly. The difference of the two signals at Q4, 3.5 MHz, is selected and amplified by 3.5 MHz buffer amplifier Q5 and applied as one of the two inputs to the phase detector at A2-B.

At pin A of J0801, the 500 kHz reference signal is applied to a double tune tank which is tuned to the seventh harmonic (3.5 MHz) and amplified by A1. The output of A1, 3.5 MHz, is filtered and applied as the second input to the phase detector circuit at A2-A.

In the phase detector, diodes CR3 and CR5 prevent the input signals from exceeding +5 Vdc. Diodes CR4 and CR6 clamp the negative portion of the input signal to ground. The two input signals are then squared by A2-A and A2-B and coupled by C22 and C24 to A2-C and A2-D, respectively. A2-C and A2-D comprise a flip-flop with a high output when A2-D is pulsed and low when A2-C is pulsed. The output is filtered to a dc voltage by C27 and coupled back to the VCXO circuitry. This dc voltage is proportional to the phase difference between the two 3.5 MHz signals.

If the signal from A5 is not exactly on frequency, indicating that the VCXO has drifted from the 19.5625 MHz crystal frequency, then a beat frequency will develop in the dc output to the VCXO. This beat frequency will vary the VCXO frequency until the VCXO has adjusted to make the 3.5 MHz signal at the phase detector exactly the same frequency as the 3.5 MHz reference.

### 8.2.3 HF VCO ASSEMBLY (724-0550)

The HF Voltage Controlled Oscillator (HF VCO) Assembly generates the 10 kHz, 1 kHz, and 100 Hz portion of the first local oscillator injection signal. Part of the first local oscillator loop number 1, the HF VCO assembly consists of an hf vco (10.000 to 10.999 MHz); a 1 kHz loop filter; MOSFET mixer

Q8; three amplifier stages A1, Q7, and Q9; and decade divider A2.

The hf vco, consisting of transistor Q4 and associated circuitry, is a grounded drain Clapp oscillator. Hf vco frequency control is maintained by the dc voltage from the 1 kHz loop filter (fine tuning) and by the vco steering voltage (coarse tuning). The vco steering voltage is controlled in turn by the position of the 10 kHz FREQUENCY MHz switch. The output frequency of the hf vco contains the 10 kHz, 1 kHz, and 100 Hz operating frequency digital information.

The control voltages are applied to varactor diodes CR3-CR6. Diodes CR3 and CR4 are controlled by the coarse tuning voltage (vco steering) and diodes CR5 and CR6 are controlled by the output of the 1 kHz loop filter (fine tuning). These varactor diodes vary the capacitance in parallel to the gate lead of Q4. Transistor Q3 provides a regulated dc supply at the drain lead of Q4 for stability and is controlled by zener diode CR8. The output of the hf vco is amplified by buffer amplifier A1 and applied to down mixer Q8 and to amplifier Q7.

Down mixer Q8 mixes the output of the hf vco with a fixed 12 MHz reference signal. The difference between these two signals is selected by low pass filter (L10, C37, C38, and C40) as the input to amplifier Q9. The amplified output from Q9 is applied to pin V of J0551 as the HF Divider Assembly 1.001 to 2.000 MHz input signal.

Amplifier Q7 applies the output of the hf vco to decade divider A2. Diodes CR9 and CR10 clip the input signal to provide a positive 5 volt pulse at pin 6 of A2. For each ten input pulse decade divider A2 provides one output pulse, divided by ten. A bandpass filter, consisting of C43, C46, C47, L8, and L9, couples and filters the output signal of A2 (1.0000 to 1.0999 MHz) to pin K of J0551.

Loop filter, consisting of Q1, Q2, Q5, and Q6 with associated circuitry filters the output of the Divider Assembly phase detector and provides the fine tuning dc voltage to the hf vco. The tuning voltage is derived from the HF Divider Assembly Phase detector input signal at pin A of J0551. This signal is either a 1 kHz waveform, or if the hf vco is off frequency, a high or low dc voltage. Initial filtering and averaging of the input signal is provided by C5, C6, C8, and C9. Diodes CR1 and CR2 shunt resistor R4 when a rapid change in voltage is applied to pin A thus shortening the lockup time of the loop. Amplified by transistors Q1 and Q2, an emitter follower pair, the signal is applied to a notch filter. The notch filter, consisting of C13, C16, C18, R13, and R14, provides the final filtering of any remaining 1 kHz oscillations on the dc signal and couples the signal to the base lead of transistor Q5. Transistors Q5 and Q6, a Darlington pair, provide the final amplification of the signal and couple the dc voltage through R19 and L4 to diodes CR5 and CR6 for fine tuning of the hf vco.

### 8.2.4 HF DIVIDER ASSEMBLY (724-0600)

The HF Divider Assembly provides the fine tuning voltage to the HF VCO Assembly for frequency control. Part of first local oscillator loop number 1, the HF Divider Assembly consists of input amplifier A1, NAND-gate pulse-shaper A2, four presettable decade counters (A4, A5, A6, A7), one shot multivibrator A3, and phase detector A9/A10. The input signals are the 1.001 to 2.000 MHz signal from the HF VCO Assembly, a 1 kHz reference signal from the Spectrum Generator Assembly, and the preset control lines from the 10 kHz, 1 kHz, and 100 Hz FREQUENCY MHz switches.

The 1.001 to 2.000 MHz input signal is amplified by A1, pulse shaped by A2, and applied to decade counters A4 through A7. The decade counters are preset by the FREQUENCY MHz switches to provide a 1 kHz output if the input signal is on the frequency corresponding to the frequency set on the front panel. In the phase detector this frequency is compared with the 1 kHz reference signal from the Spectrum Generator Assembly. The 1 kHz reference signal is considered to have no error since it is derived directly from the frequency standard signal. Therefore, any frequency error detected by the phase detector is the result of the hf vco being off frequency. The output signal of the phase detector is applied to the HF VCO Assembly to adjust the hf vco frequency until the error is cancelled.

The 1.001 to 2.000 MHz signal from the HF VCO Assembly is applied to pin V of J0601 and coupled

to amplifier A1 by C3. Capacitor C6 couples the output of A1 to the first stage (A2-A) of NAND-gate pulse shaper A2. Diode CR1 prevents the input gate of A2-A from going below 0.7 Vdc. The output of A2-A, a negative pulse, is inverted by A2-B. The leading edge of the pulse is then differentiated by capacitor C9 and applied as the positive input to A2-C. Diode CR2 shunts the portion of the waveform that swings below +0.5 volts. At A2-C output terminal, the negative pulse is inverted by A2-D and applied as the positive pulse to decade divider A4 and to NAND gate A8.

Divide by ten preset counters A4 through A6 and divide by two counter A7 are connected in series to solve the following equation:

$$\frac{\frac{F_{in(Hz)}}{1000} + F_{preset}}{2} = 1\ kHz$$

Where $F_{in(Hz)}$ is the frequency of the hf vco at A4, $F_{preset}$ is derived from the operating frequency and is equal to 2,000 - $F_{in\ (kHz)}$ = $F_{preset}$. From this it is evident that if the input signal $F_{in(Hz)}$ is on frequency then the output will be exactly 1 kHz. If $F_{in}$ is high the output will be high and if low the output will be low. Assume an operating frequency of 12.3456 MHz set by the front panel FREQUENCY MHz switches. The hf vco for this frequency should be 10.456 MHz and the input to the preset counters from A2 at 1,544 kHz ($F_{in}$). The positions of the front panel 10 kHz, 1 kHz, and 100 Hz FREQUENCY MHz switches provide the preset digits to the counters, $2^1 + 2^2$ or 6 for A4 (100 Hz), $2^0 + 2^2$ or 5 for A5 (1 kHz), and $2^2$ or 4 for A6 (10 kHz). Starting at time zero, after the first four pulses are applied to A4 one pulse is applied to A5 and A4 switches to zero. A4 then starts counting by ten and it then takes ten more pulses for a second pulse at A5 or a total of 44 pulses at A4 for A5 to reach full count and supply the first pulse at A6. A5 starts counting by 10 as it takes a total of 544 pulses at A4 before A6 reaches full count and switches A7 output high at A8. After the next 999 pulses (the output of A6, A5, and A4 are all high) A6, A5, and A4 are all fully loaded with "9". These high signals are applied from pins 5 and 6 of each counter to NAND gate A8. When the 1,000 pulse is applied to the input of A4 it is also direct coupled to the last low input line of A8. NAND gate A8 conducts and supplies one output pulse to one shot multivibrator A3-D/A3-B. The same one thousandth pulse at A4 starts to switch A4 to zero, then A5 and A6 to zero and eventually A7 to zero. However, the total propagation time of this is large compared with the almost instantaneous output of A3-D, therefore, the output of A3-D/A3-B, through A3-C and A3-A, is applied to all counters to switch then back to the preset count and to start the cycle over again. All of this provides one output pulse at A8 for each 1,544 input pulses at A4 or 1,000 pulses for an input of 1,544 kHz. Any other input signal, if on frequency, will result in the same 1 kHz output.

If the synthesizer is in VFO operation, a ground is applied at pin 15 of J0601. This ground signal disables NAND gate A3-4 to keep counters A4 and A5 from presetting.

The counter output of one-shot multivibrator A3-D/A3-B is also applied to the input of phase detector at A9 pins 5 and 7. The second input to the phase detector, the 1 kHz reference signal at J0601 pin C, is applied at pin 1 and 3 of A9.

The phase detector compares the two input frequencies by alternately counting the pulses of each input signal in sequence. If both input signals have the same frequency the phase detector output will be a rectangular 1 kHz waveform. The width of the pulse represents the phase angle between the two signals. If the counter output frequency is higher than 1 kHz then the phase detector will eventually receive two counter pulses in between a pair of reference pulses. When this happens the phase detector gets out of sequence and locks high. The high signal is used to reduce the hf vco frequency until the phase detector counts two reference pulses between a pair of counter pulses. This causes the hf vco to increase in frequency, the phase detector comes out of lock, and the hf vco stops adjusting. The loop is then phase locked. Any minute adjustment required of the hf vco is accomplished by the pulse width from the phase detector. If the counter frequency is less than 1 kHz then the phase detector locks low until the hf vco frequency is corrected.

### 8.2.5 14 MHz UP-MIXER AND VFO ASSEMBLY (724-0900)

In the 14 MHz Up-Mixer and VFO Assembly the 1.0000 to 1.0999 MHz output of the HF VCO Assembly is mixed with either a 15 MHz reference signal or a variable 14.990 to 15.000 MHz signal. The difference between the two mixed frequencies, 14.000 to 13.900 MHz is selected and applied to Translator Assembly 724-0850. The variable 14.990 to 15.000 MHz signal is selected and controlled during vfo operation by the 1 kHz FREQUENCY MHz switch on the front panel of the unit.

The input signals to the 14 MHz Up-Mixer and VFO Assembly are the 1.0000–1.0999 MHz signal from the HF VCO Assembly, a 15 MHz reference signal from the Spectrum Generator Assembly, and the vfo control and command signals from the 1 kHz switch. Basically the assembly consists of a mixer stage, three amplifiers, three transistor switches, a VCXO, and a dc amplifier.

At A2 the 1.0000 to 1.0999 MHz input signal is mixed with either the 15 MHz reference signal from the Spectrum Generator Assembly or, for vfo operation, a 14.990 to 15.000 MHz VCXO signal. The output of A2 is tuned by a three pole bandpass filter to extract the 13.9001 to 14.0000 MHz difference frequency. This signal is then amplified by A4 and applied to pin H of J0901 for connection to the Translator Assembly.

When vfo operation is selected, by pulling out on the 1 kHz FREQUENCY MHz switch, the vfo command signal (ground) switches the 15 MHz reference signal buffer amplifier A1 off through transistor Q1 switch and switches VCXO buffer amplifier A3 on through transistor switch Q2. The output of the selected buffer amplifier is applied on a common line to mixer A2, pin 10.

The variable vfo control voltage is applied to dc amplifier Q5 to control the frequency of the VCXO. The control voltage is adjustable by the rotation of the 1 kHz FREQUENCY MHz control to provide the proper VCXO output frequency at buffer amplifier A3.

### 8.2.6 TRANSLATOR ASSEMBLY (724-0850)

Translator Assembly 724-0850 provides the circuitry for transferring the 10 MHz, 1 MHz, and 100 Hz loop number one information of the first local oscillator to loop number two. This is accomplished by mixing the output of loop number one, converted up to 13.9001 to 14.0000 MHz by the 14 MHz Up-Mixer and VFO Assembly with a 160 MHz reference signal (the 20 MHz output of the Spectrum Generator Assembly multiplied by eight). The difference is then selected (approximately 146 MHz) and mixed with the output of the VHF VCO Assembly, first local oscillator output (156.0000 to 185.9999 MHz). The difference between these two signals is selected and applied as the 10.0 to 39.9 MHz input to the VHF Divider Assembly.

The 20 MHz output from the Spectrum Generator Assembly is applied to pins 18 and V of J0851, amplified by A1, and coupled to the input of pulse generator A2. Pulse generator A2 is a one shot with the output applied to a double tuned tank circuit, tuned to 160 MHz. The output of the tuned tank circuit is applied to Q1 and Q7. MOSFET Q1 provides the final amplification and filtering of the 160 MHz signal before it is applied to the input of the Second Local Oscillator Assembly 724-0800.

The 160 MHz signal at Q7 is amplified and applied as one input to MOSFET Up-Mixer Q2. The second signal at Q2 is the 13.9001 to 14.0000 MHz signal from the 14 MHz Up-Mixer and VFO Assembly.

The difference of the two frequencies (approximately 146 MHz) at Q2 is selected by the tuned input circuit of amplifier Q8. From Q8 the 146 MHz signal is applied as one of two input signals at MOSFET Down-Mixer Q4. The second input to Q4 is the first local oscillator output signal, applied at pins 1 and A of J0851 and amplified by Q3. The tuned input circuit of broadband amplifier Q5 and Q6 selects the difference of the two signals at Q4, 10.0 to 39.9 MHz as the output signal to VHF Divider 724-0700 at pins E and 5 of J0851.

## 8.2.7 VHF DIVIDER ASSEMBLY (724-0700)

VHF Divider Assembly 724-0700, part of loop number two, provides the 25 kHz fine tuning signal to the VHF VCO Assembly for frequency control. The assembly consists of an input broadband amplifier and driver, counters, a digital switch, and a phase detector. Input signals are the 10.0 to 39.9 MHz signal from the Translator Assembly, a 25 kHz reference signal from the Spectrum Generator Assembly, the 10 MHz BCD information from the VHF VCO Assembly, and the 1 MHz and 100 kHz preset control lines from the FREQUENCY MHz switches.

The 10.0 to 39.9 MHz input signal from the Translator Assembly is coupled to pin F of J0701, amplified by broadband amplifier Q1 through Q4 and driver amplifier Q5 and Q6 and applied to the input of divide by four counter A5.

The counters in the VHF Divider Assembly are preset by the FREQUENCY MHz switches (operating frequency) to count the input signal, 10.0 to 39.9 MHz, down to 25 kHz. The output of the counters is then applied to the phase detector where it is compared with the 25 kHz reference signal from the Spectrum Generator. If the input signal at the counters is off frequency (an error in the vhf vco output signal) then the input to the phase detector will contain that frequency error and the phase detector will come out of sync, 25 kHz, and lock either high or low depending on the error. This signal is applied to the VHF VCO Assembly to change the vhf vco frequency (fine tuning) in the direction that will result in eliminating the error in the 25 kHz signal at the phase detector. Because of the relative long presetting time of the counters and the high frequency that they are counting, the following scheme has been devised in the VHF Divider Assembly.

The counters are divided into two groups, with the input signal switch back and forth by a digital switch. When the first group is counting the second group is presetting and when the second group is counting the first group is presetting. The first group consists of the 100 kHz preset counters A3, A6, A8, and A10. The second group consists of the divide by ten counter (A11, A13, A14, and A15), 1 MHz divide by ten preset counter A16 (N2). and divide by four 10 MHz preset counter A1 (N3). A7 and A9 compose the digital switch.

At time t = 0 the input from A5 is applied to the first group. As soon as enough pulses have been applied to fill up the first group ($10\text{-}N_1$) then the input is switched to the second group. The second group of counters will fill up after $10\cdot(10\text{-}N_2) + (3\text{-}N_3)\cdot 100$ pulses. After this the process repeats itself. The rate that the decade switch is switching the input back and forth equals 25 kHz if the input is on frequency and 25 kHz $\pm$ difference frequency if the signal is off. This signal from the decade switch is applied to phase detector A6 and A7 on the 724-0720 sub-assembly.

## 8.2.8 VHF VCO ASSEMBLY (724-0650)

VHF VCO Assembly 724-0650, part of phase lock loop number two, provides the first local oscillator injection signal (156.0000 – 185.9999 MHz) to the Receiver Module and to the Translator Assembly. The output signal is generated by one of three selectable voltage controlled oscillators (vco). Each oscillator has a 10 MHz bandwidth and are selected by the 10 MHz FREQUENCY MHz switch. Coarse frequency control of the selected oscillator is accomplished by the 1 MHz FREQUENCY MHz control voltage. Fine tuning is provided by the 25 kHz phase detector output from the VHF Divider Assembly. The VHF VCO Assembly consists of three vco's (156-166 MHz, 166-176 MHz, and 176-186 MHz), two dual-stage emitter follower amplifiers, an agc amplifier, a 25 kHz loop filter, and two BCD converters.

The position of the 10 MHz FREQUENCY MHz switch supplies a closure to ground at either E11 (0 position), E12 (position 1), or E5 (position 2). The ground signal energizes, through transistor switch Q4, A5, or Q6 respectively, the proper vco. The ground signal at E11 and E12 is also applied to BCD converters Q2 and Q3 which supply the 10 MHz BCD switching information to the VHF Divider Assembly.

Control of the selected vco is accomplished by varactor diodes, two in each vco. The capacitance of

one varactor is controlled by the coarse tuning voltage from the 1 MHz voltage divider network. The other varactor diode is controlled by the output of the 25 kHz loop filter, fine tuning.

The vco output is applied to two amplifiers. Amplifier Q2 and Q4 supply the output of the selected vco to the Translator Assembly as the feedback signal to complete loop number two, paragraph 8.2.6. The other amplifier, Q1 and Q3, supplies the vco output signal to the Receiver Module as the first local oscillator injection signal. Transistors Q5 and Q6 provide gain control of the output signal to the Receiver Module.

The 25 kHz loop filter adjusts the output of the vco by filtering the rectangular output of the VHF Divider rectangular waveform to a dc level. The dc signal is then amplified by Q1 with any remaining 25 kHz oscillation removed by the output notch-filter network at the emitter of Q1.

## 8.3 PERFORMANCE CHECKS

Perform the following check to determine the overall performance of the Synthesizer Module.

8.3.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Coax test cable – RF P/N 724-0032

b. Rf vtvm – Boonton, Model 91C

c. Frequency counter – Hewlett Packard, Model 5245L with 5253B plug-in head.

8.3.2 PRELIMINARY

a. At Synthesizer Module disconnect coaxial cables P0505 (yellow), P0504 (green), and P0503 (red).

b. At front panel of RF-505 set FREQUENCY MHz switches at 1.60000 MHz.

8.3.3 PROCEDURES

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.3.2. Set MODE switch at LSB. | |
| 2. | Rf vtvm at J0504 (green) terminated with 50 ohm load. | Connect the rf vtvm at J0504 (green) using the coax test cable and measure the voltage. | Greater than 150 mVrms. |
| 3. | Rf counter at J0504 (green). | Connect the counter to the coax test cable and measure the frequency. | 156.5000 MHz. |
| 4. | Rf vtvm at J0503 (red) terminated with 50 ohm load. | Connect the rf vtvm at J0503 using the coax test cable and measure the voltage. | 7 mVrms. |
| 5. | Rf counter at J0503 (red). | Connect the counter to the coax test cable and measure the frequency. | 1.0000 MHz. |
| 6. | Rf counter at J0505 (yellow). | Connect the rf counter at J0505 (yellow) using the coax test cable. Measure the frequency with the front panel FREQUENCY MHz switches set at the following positions:<br>01.2345 MHz<br>02.3456 MHz<br>03.4567 MHz<br>04.5678 MHz<br>15.6789 MHz<br>16.7890 MHz<br>17.8901 MHz<br>28.9012 MHz<br>29.0123 MHz<br>20.1234 MHz | Counter should indicate the following frequencies:<br>157.2345 MHz<br>158.3456 MHz<br>159.4567 MHz<br>160.5678 MHz<br>171.6789 MHz<br>172.7890 MHz<br>173.8901 MHz<br>184.9012 MHz<br>185.0123 MHz<br>176.1234 MHz |
| 7. | Rf vtvm at J0505 (yellow) terminated with 50 ohms. | Repeat step 6 while measuring the rf voltage at J0505. | Greater than 150 mV for each setting. |

## 8.4 FAULT ANALYSIS

The Synthesizer Module fault analysis table is presented in the following subparagraphs. This table is designed to isolate a faulty assembly first and then a faulty stage. If the defective assembly has already been isolated by substitution, then the technician can proceed directly to the appropriate paragraph and proceed from there to isolate the faulty stage. Once a defective stage has been found, refer to the appropriate circuit diagram and make voltage checks to locate the faulty component. Suspected faulty assemblies can be verified by substitution with a known good assembly.

**NOTE**

*After a defective assembly or component has been replaced, proceed to the alignment procedures located in this chapter.*

### 8.4.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Oscilloscope – Tektronix, Model 454.

b. Rf vtvm – Boonton, Model 91C

c. Frequency Counter – Hewlett-Packard, Model 5245L.

d. Spectrum Analyzer – Nelson-Ross, Model PSA-11.

e. Rf Signal Generator – Hewlett-Packard, Model 608.

f. 50 ohm Probe Termination – Boonton, Model 91-8B.

g. Extender – RF Communications, RF P/N 724-0060.

h. Coaxial cable terminated with male BNC connector on one end and alligator clips on the other.

i. Coaxial adapter; BNC to miniature – Sealectro No. 51-074-680.

j. Test Adapter – RF Communications, RF P/N 724-0708.

### 8.4.2 PRELIMINARY

a. At front panel, set MODE switch at OFF, FREQUENCY MHz switches at 1.6000 MHz, SPEAKER switch at OFF, PRESELECTOR switch at OUT.

b. At RF-505, remove top and Synthesizer Module covers.

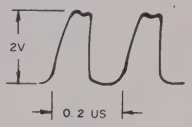
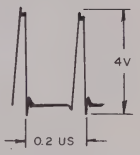
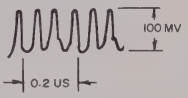
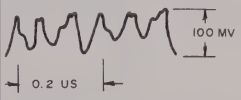
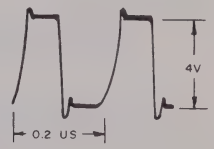
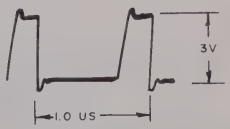
c. At Receiver Module, disconnect P1002 (yellow), P1003 (red), and P1004 (green).

d. At RF-505 set MODE switch at LSB.

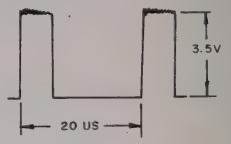
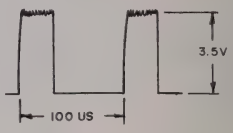
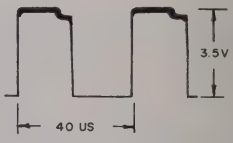
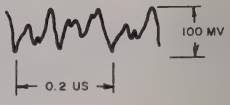
**NOTE**

*During the following procedures refer to the circuit diagram associated with the assembly under test.*

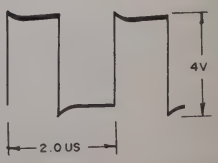
## 8.4.3 SPECTRUM GENERATOR ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the Spectrum Generator Assembly for access. | |
| 2. | Oscilloscope probe at J0751 pin P, ground probe on chassis. | Check for proper waveform. | 800 mV, 5 MHz sinewave. |
| 3. | Oscilloscope probe at A1 pin 6. | Check for proper waveform. |  |
| 4. | Oscilloscope probe at A2 pin 11. | Check for proper waveform. |  |
| 5. | Oscilloscope probe at A8 pin 2. | Check for proper waveform. |  |
| 6. | Oscilloscope probe at A8 pin 6. | Check for proper waveform. | 3.5 V, 20 MHz sinewave. |
| 7. | Oscilloscope probe at A10 pin 2. | Check for proper waveform. |  |
| 8. | Oscilloscope probe at A10 pin 6. | Check for proper waveform. | 4 V, 15 MHz sinewave. |
| 9. | Oscilloscope probe at A3 pin 6. | Check for proper waveform. |  |
| 10. | Oscilloscope probe at A3 pin 8. | Check for proper waveform. |  |
| 11. | Oscilloscope probe at A3 pin 5. | Check for proper waveform. | |

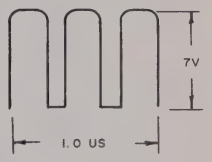
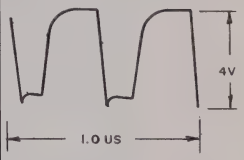
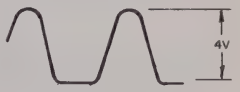
## 8.4.3 SPECTRUM GENERATOR ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 12. | Oscilloscope probe at A4 pin 12. | Check for proper waveform. |  |
| 13. | Oscilloscope probe at A5 pin 12. | Check for proper waveform. |  |
| 14. | Oscilloscope probe at A5 pin 5. | Check for proper waveform. |  |
| 15. | Oscilloscope probe at A6 pin 12. | Check for proper waveform. | |
| 16. | Oscilloscope probe at A9 pin 2. | Check for proper waveform. |  |
| 17. | Oscilloscope probe at A9 pin 6. | Check for proper waveform. | 400 mV, 12 MHz sinewave. |
| 18. | Oscilloscope probe at junction of R30 and R31. | Check for proper waveform. | 350 mV, 12 MHz sinewave. |
| 19. | Oscilloscope probe at junction of R38 and R39. | Check for proper waveform. | 3.5 V, 1 MHz sinewave. |

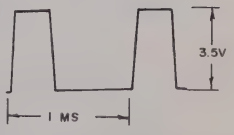
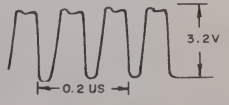
## 8.4.4 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the Second Local Oscillator Generator Assembly for access. | |
| 2. | Oscilloscope probe at J0801 pin A, ground probe on chassis. | Check for proper waveform. |  |

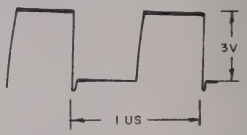
## 8.4.4 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 3. | Oscilloscope probe at E2. | Check for proper waveform. | 4 V, 3.5 MHz sinewave. |
| 4. | Oscilloscope probe at E1. | Check for proper waveform. |  |
| 5. | Oscilloscope probe at TP1. | Check for proper waveform to indicate phase lock. |  |
| 6. | Oscilloscope probe at TP2. | Check for proper 19.5625 MHz waveform. | |
| 7. | Oscilloscope probe at A3 pin 8. | Check for proper 19.5625 MHz waveform. |  |
| 8. | Oscilloscope probe at J0801 pin V. | Check for proper waveform. | 150 mV, 156.5 MHz sinewave. |

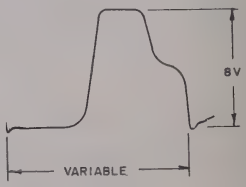
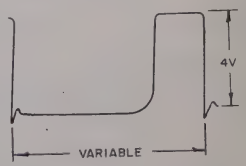
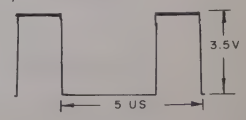
## 8.4.5 HF VCO ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br>Using assembly extender (RF P/N 724-0060), extend the Hf Vco Assembly for access. | |
| 2. | Oscilloscope probe at J0551 pin A, ground probe on chassis. | Check for proper waveform. Pulse width will vary slightly with preset frequency. |  |
| 3. | Oscilloscope probe at A1 pin 2. | At front panel, rotate 10 kHz, 1 kHz, and 100 Hz switches from 0.0000 to 0.0999 MHz. Check for proper waveform. | 200 mV sinewave should vary from 10 MHz to 10.999 MHz. |
| 4. | Oscilloscope probe at E1. | Same as step 3. | 9 V distorted sinewave should vary from 10 MHz to 10.999 MHz. |
| 5. | Oscilloscope probe at A2 pin 6. | At front panel, set 10 kHz, 1 kHz, and 100 Hz switches at 0.0000 MHz. Check for proper waveform. |  |

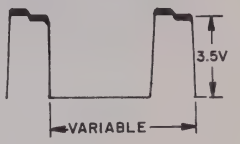
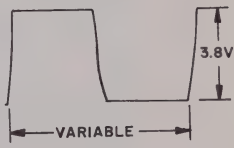
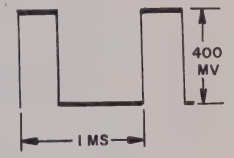
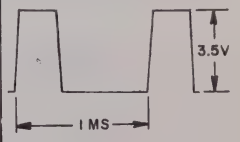
## 8.4.5 HF VCO ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 6. | Oscilloscope probe at E2. | Check for proper waveform. |  |
| 7. | Oscilloscope probe at J0551 pin K. | Check for proper waveform. | 300 mV, 1 MHz sinewave. |
| 8. | Oscilloscope probe at J0551 pin R. | Check for proper 12 MHz waveform. | |
| 9. | Oscilloscope probe at base of Q9. | Same as step 3. | 500 mV 2 MHz sinewave at 0.0000 MHz. 650 mV 1 MHz sinewave at 0.0999 MHz. |
| 10. | Oscilloscope probe at J0551 pin V. | Same as step 3. | 400 mV, 1-2 MHz sinewave. |

## 8.4.6 HF DIVIDER ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the Hf Divider Assembly for access. | |
| 2. | Oscilloscope probe at J0601 pin V, ground probe on chassis. | At front panel, rotate 10 kHz, 1 kHz, 1 kHz, and 100 Hz switches from 0.0000 MHz to 0.0999 MHz. Check for proper waveform. | 400 mV, 1-2 MHz sinewave. |
| 3. | Oscilloscope probe at A1 pin 6. | Same as step 2. |  |
| 4. | Oscilloscope probe at A4 pin 8. | Same as step 2. |  |
| 5. | Oscilloscope probe at A4 pin 12. | At front panel, set 10 kHz, 1 kHz, and 100 Hz switches at 0. Rotate 100 Hz switch. Ghost pulse should appear and travel 1/10 of distance between pulses for each increment 100 Hz switch is turned. |  |

## 8.4.6 HF DIVIDER ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 6. | Oscilloscope probe at A5 pin 12. | At front panel, rotate both 1 kHz and 100 Hz switches to move ghost pulse. Pulses will also diverge as frequency increases. |  |
| 7. | Oscilloscope probe at A6 pin 12. | At front panel, rotation of 10 kHz, 1 kHz, and 100 Hz switches will make ghost pulse travel. Pulses will diverge as frequency increases. | |
| 8. | Oscilloscope probe at A7 pin 8. | Waveform should be 1/2 frequency of A6 pin 12 at any one switch setting. |  |
| 9. | Oscilloscope probe at A3 pin 9. | Check for proper waveform. |  <br>Waveform should be the same at any preset frequency. |
| 10. | Oscilloscope probe at J0601 pin A. | Check for proper waveform. Pulse width will vary slightly with preset frequency. |  |

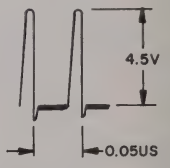
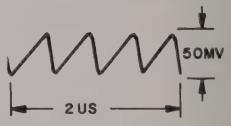
## 8.4.7 14 MHz UP-MIXER AND VFO ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the 14 MHz Up-Mixer and Vfo Assembly for access. | |
| 2. | Oscilloscope probe at J0901 pin A, ground probe on chassis. | Check for proper waveform. | 350 mV, 1 MHz sinewave. |
| 3. | Oscilloscope probe at J0901 pin N. | Check for proper waveform. | 350 mV, 15 MHz sinewave. |
| 4. | Oscilloscope probe at A1 pin 6. | Check for proper waveform. | 12 V, 15 MHz sinewave. |
| 5. | Oscilloscope probe at J0901 pin H. | Check for proper waveform. | 2.5 V, 14 MHz sinewave. |

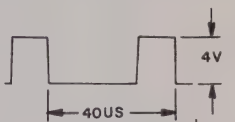
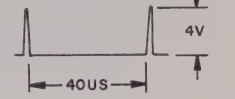
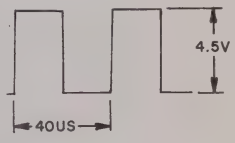
## 8.4.7 14 MHz UP-MIXER AND VFO ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 6. | Oscilloscope probe at A3 pin 1. | At front panel, pull out 1 kHz knob and rotate from 0 to 9. Check for proper waveform. | 125 mV, 1 MHz modulated 14 to 15 MHz waveform. |
| 7. | Oscilloscope probe at A3 pin 6. | Same as step 6. | 4.0 to 4.5 V, 14 to 15 MHz sinewave. |

## 8.4.8 TRANSLATOR ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the Translator Assembly for access. | |
| 2. | Oscilloscope probe at J0851 pin V, ground probe on chassis. | Check for proper waveform. | 1 V, 20 MHz sinewave. |
| 3. | Oscilloscope probe at A1 pin 6. | Check for proper waveform. | 4.5 V, 20 MHz sinewave. |
| 4. | Oscilloscope probe at A2 pin 6. | Check for proper waveform. |  |
| 5. | Oscilloscope probe at J0851 pin R. | Check for proper waveform. |  |
| 6. | Oscilloscope probe at TP2. | Check for proper waveform. | 100 mV, 146.0 MHz sinewave. |
| 7. | Oscilloscope probe at junction of R29 and R30. | Check for proper waveform. | 400 mV, 157.6 MHz sinewave. |
| 8. | Oscilloscope probe at base of Q5. | Check for proper waveform. | 200 mV, 11.6 MHz sinewave. |
| 9. | Oscilloscope probe at J0851 pin E. | Check for proper waveform. | 400 mV, 11.6 MHz sinewave. |

## 8.4.9 VHF DIVIDER ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend Vhf Divider Assembly for access. Using test adapter (RF P/N 724-0708) extend Vhf Divider Board Number 2 for access. | |
| 2. | Oscilloscope probe at J0701 pin F, ground probe on chassis. | Check for proper waveform. | 400 mV, 11.6 MHz sinewave. |
| 3. | Oscilloscope probe at J0701 pin A. | Check for proper waveform. |  |
| 4. | Oscilloscope probe at J0711 pin D. | Check for proper waveform. |  |
| 5. | Oscilloscope probe at TP1. | Check for proper waveform. |  |
| | | **NOTE**<br>*If waveform is not present, either a high or low condition will exist. By manipulation of the 10 MHz, 1 MHz, and 0.1 MHz switches, the phase detector should be made to change state. If this can be done, it can be assumed that the phase detector is working properly.* | |
| 6. | | At Vhf Vco Assembly 724-0650, ground junction of R11 and R12 to chassis. | |
| 7. | Oscilloscope probe at J0711 pin D. | Set oscilloscope on expanded scale and focus on second pulse. At front panel set FREQUENCY MHz switches at 19.9000 MHz. Rotate 10 MHz switch. | Pulse should move to right in equal increments for each step. |
| 8. | Same as step 6. | Same as step 6 except rotate 1 MHz switch. | Pulse should move to right in equal increments for each step. Increments should be smaller than in step 6. |
| 9. | Same as step 6. | Same as step 6 except rotate 0.1 MHz switch. | Pulse should move to right in equal increments for each step. Increments should be smaller than in step 7. |

## 8.4.10 VHF VCO ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2. | |
| 2. | Connect frequency counter and rf vtvm with 50 ohm termination to P1002 (yellow) at the Receiver Module. | At front panel set FREQUENCY MHz switches to the following settings. Check for proper output frequency.<br><br>01.2345 MHz<br>02.3456 MHz<br>03.4567 MHz<br>04.5678 MHz<br>15.6789 MHz<br>16.7890 MHz<br>17.8901 MHz<br>28.9012 MHz<br>29.0123 MHz<br>20.1234 MHz<br><br>**NOTE**<br><br>*If improper results are obtained for any one position of the 10 MHz switch, the most probable fault is one of the vco's. If other improper results are obtained, make sure that none of the other assemblies is at fault before replacing the Vhf Vco Assembly.* | Rf vtvm should indicate greater than 150 mV for each reading.<br><br>157.2345 MHz<br>158.3456 MHz<br>159.4567 MHz<br>160.5678 MHz<br>171.6789 MHz<br>172.7890 MHz<br>173.8901 MHz<br>184.9012 MHz<br>185.0123 MHz<br>176.1234 MHz |

## 8.5 ALIGNMENT PROCEDURES

### 8.5.1 SPECTRUM GENERATOR ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the Spectrum Generator Assembly for access. | |
| 2. | Spectrum analyzer probe at J0751 pin V, ground probe on chassis. | Tune L2, L3, L4 and L6 for maximum output at 20 MHz.<br><br>**NOTE**<br><br>*The adjustments of L2, L3, and L4 interact and the tuning sequence must be repeated until no further increase in output is obtained.* | Maximum output at 20 MHz. Undesired signals 5 MHz on either side of 20 MHz are normally present. The strongest of these must be at least 45 dB down from the 20 MHz signal. |
| 3. | Disconnect spectrum analyzer probe from pin V and connect rf vtvm probe. Ground probe on chassis. | Measure 20 MHz output. | Greater than 90 mVrms. |

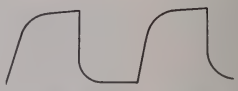
## 8.5.1 SPECTRUM GENERATOR ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 4. | Spectrum analyzer probe at J0751 pin S. | Tune L10, L11, L12, and L14 for maximum output at 15 MHz.<br>**NOTE**<br>*The adjustments of L10, L11 and L12 interact and the tuning sequence must be repeated until no further increase in output is obtained.* | Maximum output at 15 MHz. Undesired signals 5 MHz on either side of 20 MHz are normally present. The strongest of these must be at least 45 dB down from the 5 MHz signal. |
| 5. | Disconnect spectrum analyzer probe and connect rf vtvm probe to pin S. | Measure 15 MHz output. | Output between 50 and 150 mVrms. |
| 6. | | Connect rf signal generator to spectrum analyzer and establish 12 MHz as center frequency of spectrum analyzer screen. Disconnect rf signal generator from spectrum analyzer. | |
| 7. | Spectrum analyzer probe at J0751 pin K. | Tune L5, L7, L8, L9, and L13 for maximum output at 12 MHz.<br>**NOTE**<br>*The adjustments of L5, L7, L8, and L9 interact and the tuning sequence must be repeated until no further increase in output is obtained.* | Maximum output at 12 MHz. Undesired signals at 1 MHz spacing are normally present. The strongest of these must be at least 50 dB down from the 12 MHz signal. |
| 8. | Disconnect spectrum analyzer probe and connect rf vtvm probe to pin K. | Measure 12 MHz output. | Greater than 125 mVrms. |

## 8.5.2 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br>Using assembly extender (RF P/N 724-0060), extend Second Local Oscillator Generator Assembly for access. | |
| 2. | Oscilloscope probe at TP2, ground probe on chassis. | Adjust L5 for maximum output at 19.5625 MHz. | Maximum output. |
| 3. | Spectrum analyzer probe at J0801 pin V, ground probe on chassis. | Adjust C26, C30, C33, C41, and C45 for maximum output at 156.5 MHz. | Maximum output. All spurious signals must be at least 25 dB down from the 156.5 MHz signal. |
| 4. | Disconnect spectrum analyzer probe and connect rf vtvm probe at pin V. | Measure output and readjust C26, C30, C33, C41, and C45 if necessary. | Greater than 150 mVrms. |
| 5. | Oscilloscope probe at E1. | Tune C40, L15, and L19 for maximum output at 3.5 MHz.<br>**NOTE**<br>*It is normal to observe slight clipping on peaks of this waveform.* | Output greater than 2 V peak-to-peak. |

## 8.5.2 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 6. | Oscilloscope probe at E2. | Tune L3, L4, and C3 for maximum output at 3.5 MHz.<br>**NOTE**<br>*The adjustments of L3 and L4 interact slightly and the adjustments must be repeated until no further increase in output is obtained. It is normal to observe slight clipping on peaks of this waveform. C3 is adjusted with the assembly off the extender. By removing the assembly adjusting C3 and then replacing the assembly to check the adjustments. This procedure is repeated until a peak is obtained.* | Output greater than 2 V peak-to-peak.<br>  |
| 7. | Oscilloscope probe at TP1. | Adjust L2 until locked waveform is obtained with 50% duty cycle. Slight adjustment of L5 may be necessary. | Locked waveform with 50% duty cycle. |

## 8.5.3 HF VCO ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br>Using assembly extender (RF P/N 724-0060), extend the Hf Vco Assembly for access. | |
| 2. | | Turn C10 in all the way, then back off five turns. At front panel, set 1 kHz switch at 5. | |
| 3. | Oscilloscope probe at J0551 pin A, ground probe on chassis. | Adjust L2 until oscilloscope displays 50% duty cycle. | Oscilloscope displays 50% duty cycle. |
| 4. | Same as step 3. | Rotate 1 kHz switch from 0 to 9.<br>**NOTE**<br>*If loop does not stay in lock, back off 1 turn on C10 and repeat steps 3 and 4.* | Oscilloscope should display rectangular wave indicating loop lock. |

## 8.5.4 HF DIVIDER ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| | | Alignment of this assembly is not required. | |

## 8.5.5 14 MHz UP-MIXER AND VFO ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend the 14 MHz Up-Mixer and VFO Assembly for access. | |
| 2. | | Connect rf signal generator to the spectrum analyzer and establish a 14 MHz center frequency on the screen. Disconnect rf signal generator. | |
| 3. | Spectrum analyzer probe at J0901 pin H, ground probe on chassis. | Adjust L3, L5, L6, and L7 in sequence for maximum 14 MHz output. Peak 14 MHz output with L2. | |
| 4. | Same as step 3. | Null 15 MHz signal with C14. | Null 15 MHz signal. |
| 5. | Same as step 3. | Peak 14 MHz signal with L3. | Peak 14 MHz signal. |
| 6. | Same as step 3. | Repeat steps 4 and 5. | |
| 7. | Same as step 3. | Adjust L5, L6, and L7 for maximum output at 14 MHz. | Maximum output at 14 MHz. |
| 8. | Same as step 3. | Repeat steps 3, 4, 5 and 6 until 1 MHz sidebands are suppressed more than 40 dB below 14 MHz at maximum. | 1 MHz sidebands suppressed more than 40 dB below 14 MHz at maximum. |
| 9. | Rf vtvm probe at J0901 pin H, ground probe on chassis. | Measure 14 MHz output voltage. | Greater than 200 mVrms. |
| 10. | | At front panel, pull out 1 kHz switch to activate vfo. | |
| 11. | Frequency counter and oscilloscope probes at A3 pin 6, ground probes on chassis. | At front panel set 1 kHz switch at 0 with switch still pulled out. Adjust L9 for 14.990 MHz ±200 Hz. | 14.990 MHz ±200 Hz. |
| 12. | Same as step 11. | Rotate 1 kHz switch to 5. Measure frequency. | 14.995 MHz ±1 kHz. |
| 13. | Same as step 11. | Rotate 1 kHz switch fully clockwise. Measure frequency. | 15.000 MHz ±1 kHz. |
| 14. | Same as step 9. | Measure 14 MHz output voltage. | Greater than 100 mVrms |

## 8.5.6 TRANSLATOR ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | | Perform the preliminary procedures outlined in paragraph 8.4.2.<br><br>Using assembly extender (RF P/N 724-0060), extend Translator Assembly for access. | |
| 2. | Spectrum analyzer probe at J0851 pin R, ground probe on chassis. | Tune C6, C7, C8, C12, and C17 for maximum output at 160 MHz.<br><br>**NOTE**<br><br>*The adjustments of C7, C8, and C12 interact slightly and must be repeated until no further increase in output is obtained.* | Maximum output at 160 MHz. Spurious signals should be greater than 30 dB down from the 160 MHz signal. |
| 3. | Disconnect spectrum analyzer probe and connect rf vtvm probe to J0851 pin R, ground probe on chassis. | Retune C6, C7, C8, C12, and C17 slightly for maximum output. | Maximum output at 160 MHz. |

## 8.5.6 TRANSLATOR ASSEMBLY (CONT.)

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 4. | Spectrum analyzer probe at TP1. | Tune C23 for maximum output at 160 MHz. | Maximum output at 160 MHz. Spurious signals should be greater than 35 dB down from the 160 MHz signal. |
| 5. | Disconnect spectrum analyzer and connect rf vtvm probe at TP1. | Tune C23 slightly for maximum output. | Maximum output of 160 MHz. |
| 6. | Spectrum analyzer probe at TP2. | Tune C28, C33, and C37 for maximum output at 146 MHz. | Maximum output at 146 MHz. Spurious signal at 160 MHz should be at least 35 dB down from the 146 MHz signal. |
| 7. | Disconnect spectrum analyzer and connect rf vtvm probe at TP2. | Measure output voltage. | Greater than 25 mVrms. |

## 8.5.7 VHF DIVIDER ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| | | Alignment of this assembly is not required. | |

## 8.5.8 VHF VCO ASSEMBLY

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| | | Alignment of this assembly is not required. | |

## 8.6 CIRCUIT DIAGRAMS AND PARTS LISTS

**NOTE**

*The parts list of the assemblies are located on the back of the circuit diagrams.*

# NOTES

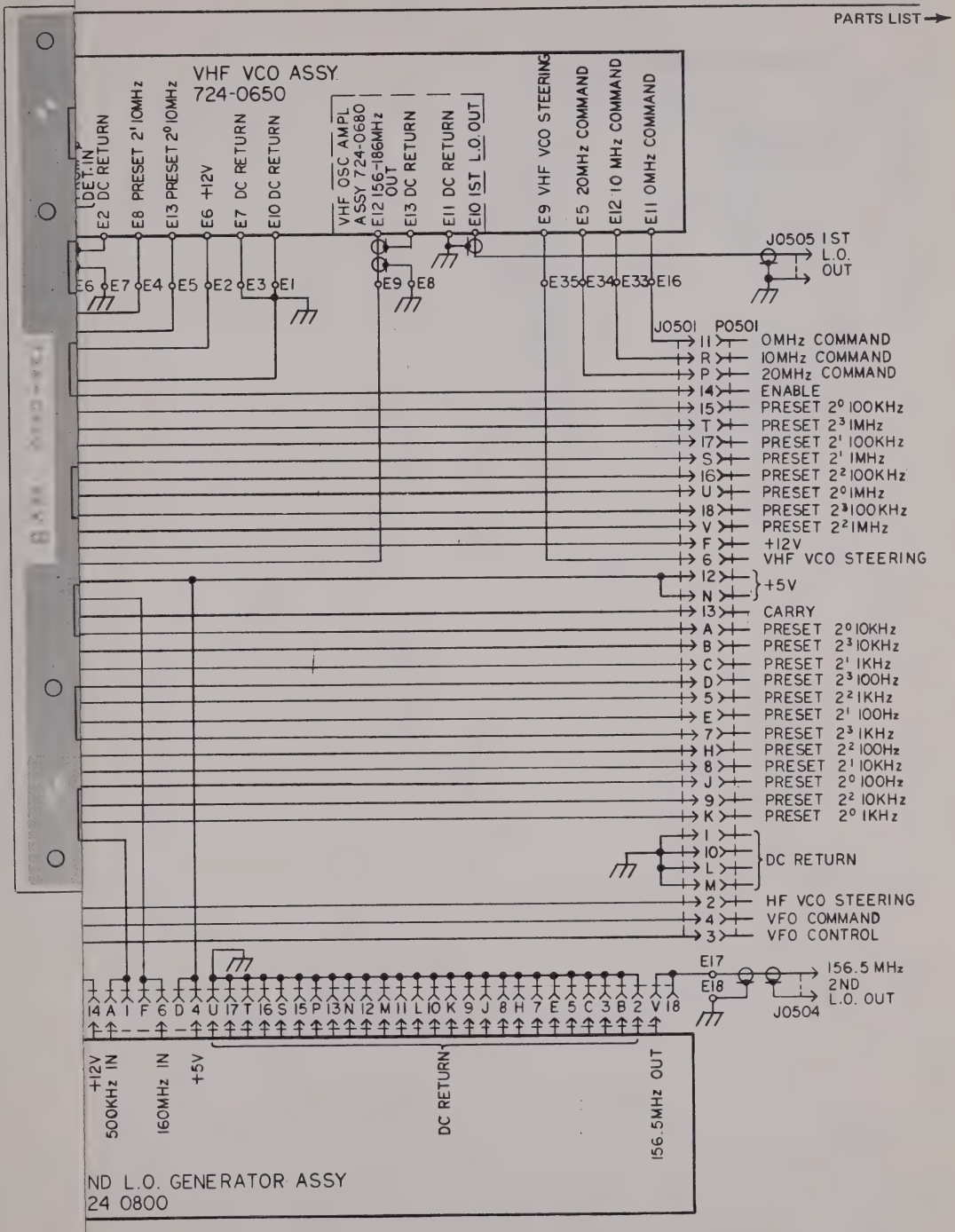
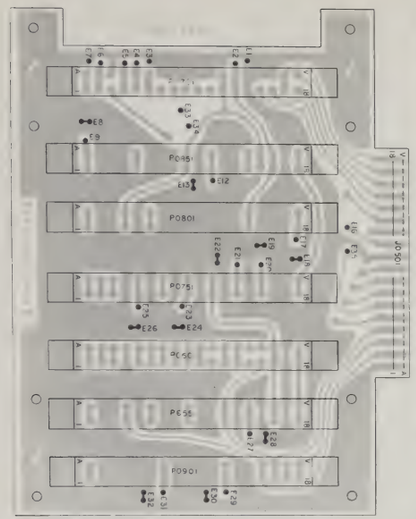
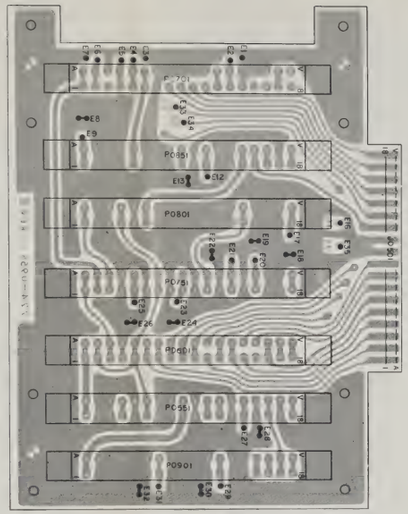



Figure 8.1 — Synthesizer Module Circuit Diagram



B. Component Locations with Adjacent Side Foil



A. Component Locations with Opposite Side Foil

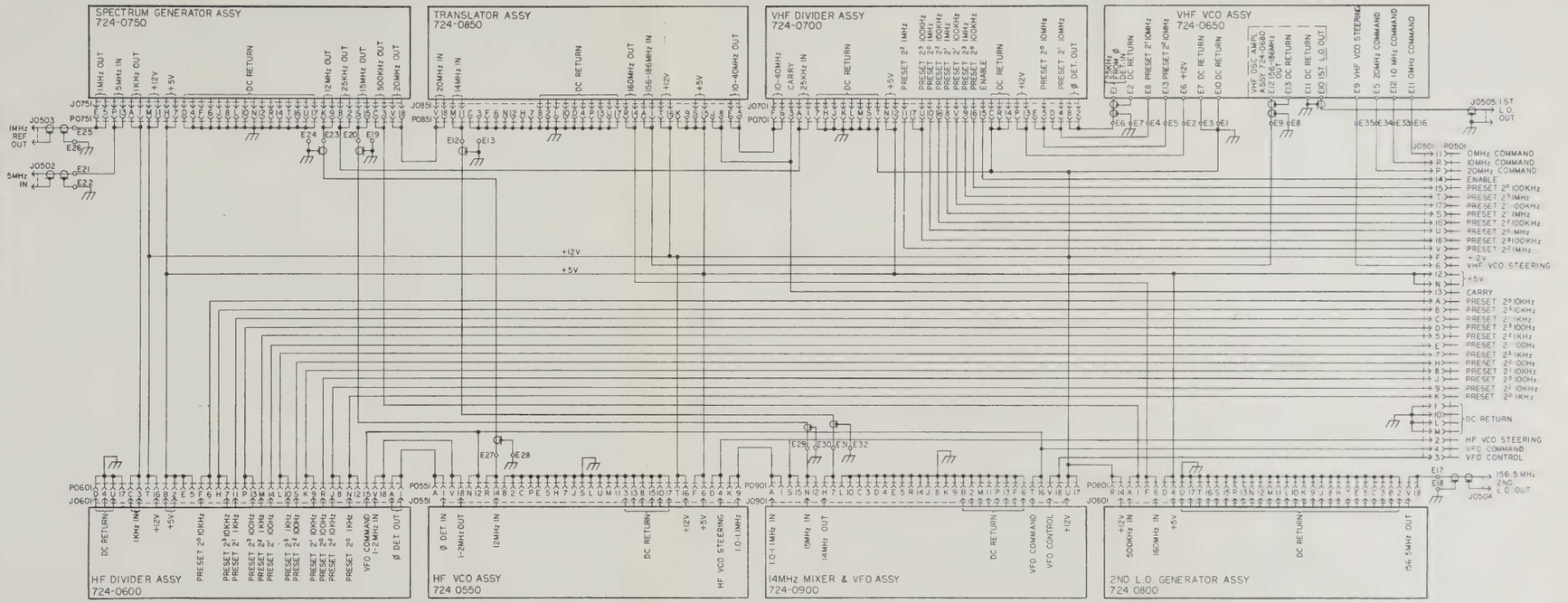
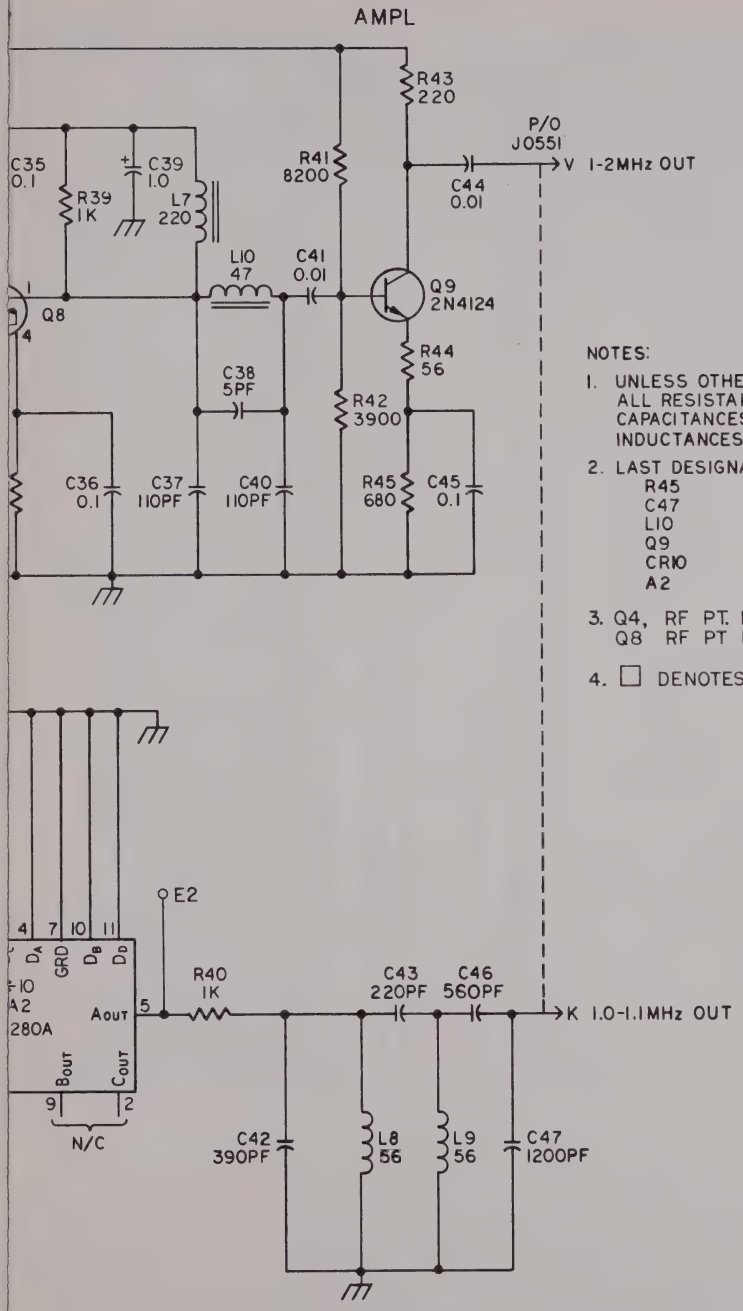



Figure 8.1 — Synthesizer Module Circuit Diagram



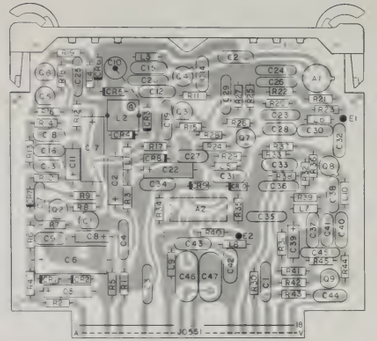

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
2. LAST DESIGNATORS:
   R45
   C47
   L10
   Q9
   CR10
   A2
3. Q4, RF PT. NO. Q-0006
   Q8 RF PT NO Q-0325
4. ☐ DENOTES LOCATING TAB ON LC.

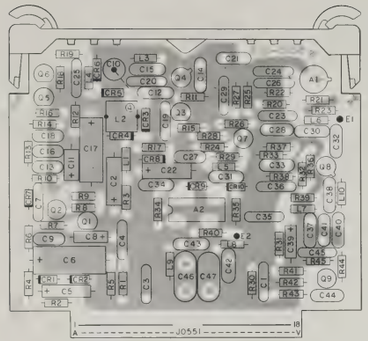
Figure 8.2 – HF VCO Assembly Circuit Diagram

## SYNTHESIZER MODULE – 724-0500

| Reference Designation | Description | RF P/N |
|---|---|---|
| J0502 | Connector, Coaxial, Male | J-0033 |
| J0503 | Connector, Coaxial, Male | J-0033 |
| J0504 | Connector, Coaxial, Male | J-0033 |
| J0505 | Connector, Coaxial, Male | J-0033 |
| P0551 | Connector, P.C. Board | 724-0143 |
| P0601 | Connector, P.C. Board | 724-0143 |
| P0701 | Connector, P.C. Board | 724-0143 |
| P0751 | Connector, P.C. Board | 724-0143 |
| P0801 | Connector, P.C. Board | 724-0143 |
| P0851 | Connector, P.C. Board | 724-0143 |
| P0901 | Connector, P.C. Board | 724-0143 |
| | Enclosure, Side | 724-0048 |
| | Enclosure, Side | 724-0049 |
| | Enclosure, End | 724-0047 |
| | Cover | 724-0051 |
| | Shield | 724-0055 |
| | HF VCO Assembly | 724-0550 |
| | HF Divider Assembly | 724-0600 |
| | VHF VCO Assembly | 724-0650 |
| | VHF Divider Assembly | 724-0700 |
| | Spectrum Generator Assembly | 724-0750 |
| | Second Local Oscillator Generator Assembly | 724-0800 |
| | Translator Assembly | 724-0850 |
| | 14 MHz Mixer and VFO Assembly | 724-0900 |
| | Synthesizer Mother Board Assembly | 724-0950 |



A. Component Locations with Opposite Side Foil

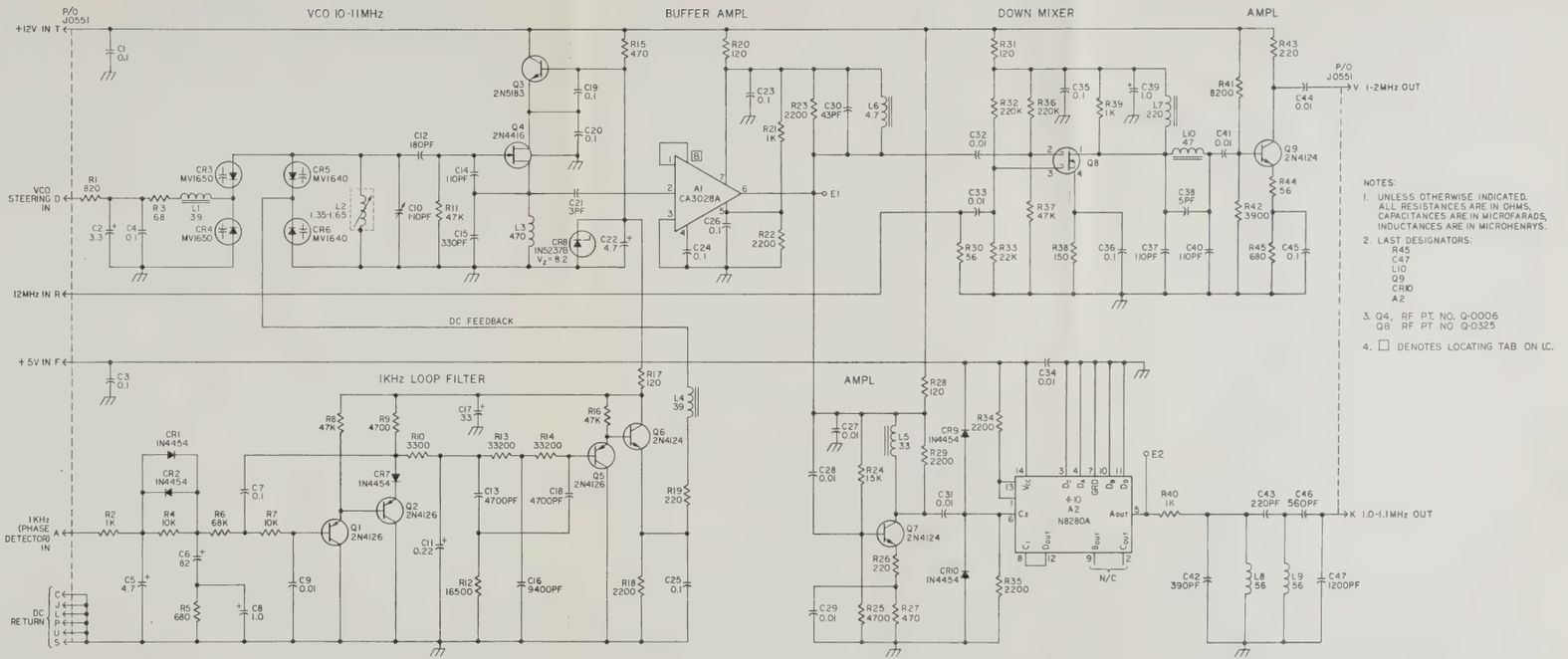


B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

| Stage | E | B | C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q1 | 1.30 V | 0.67 V | 0.00 V | | | | | | | | | | | |
| Q2 | 1.50 V | 1.20 V | 0.00 V | | | | | | | | | | | |
| Q3 | 7.30 V | 7.90 V | 12.6 V | | | | | | | | | | | |
| Q5 | 3.00 V | 2.30 V | 0.00 V | | | | | | | | | | | |
| Q6 | 2.35 V | 3.00 V | 7.60 V | | | | | | | | | | | |
| Q7 | 4.10 V | 2.70 V | 11.2 V | | | | | | | | | | | |
| Q9 | 3.50 V | 4.20 V | 11.1 V | | | | | | | | | | | |
| | Gate | Source | Drain | | | | | | | | | | | |
| Q4 | 0.00 V | 7.30 V | 0.25 V | | | | | | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | | | | | | | | | | |
| Q8 | 11.1 V | 2.10 V | 1.10 V | 1.00 V | | | | | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | | | | | | |
| A1 | 0.59 V | 3.70 V | 0.00 V | 3.00 V | 7.00 V | 10.8 V | 10.8 V | 0.59 V | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 | Pin 11 | Pin 12 | Pin 13 | Pin 14 |
| A2 | 5.00 V | 1.40 V | 0.00 V | 0.00 V | 1.55 V | 3.10 V | 0.00 V | 0.81 V | 0.81 V | 0.00 V | 0.00 V | 0.81 V | 5.00 V | 5.00 V |

* Referenced to ground.




NOTES:
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
2. LAST DESIGNATORS:
   R45
   C47
   L10
   Q9
   CR10
   A2
3. Q4, RF PT. NO. Q-0006
   Q8 RF PT. NO. Q-0325
4. ☐ DENOTES LOCATING TAB ON LC.

Figure 8.2 – HF VCO Assembly Circuit Diagram

)THERWISE INDICATED,
STANCES ARE IN OHMS,
NCES ARE IN MICROFARADS,
CES ARE IN MICROHENRYS.

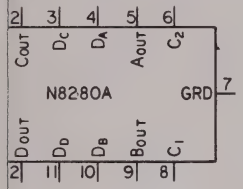
ES ARE IN4454.

SIGNATORS:

6. ☐ DENOTES LOCATING TAB ON I.C.

S:
3-SN7400N  A7 – SN7472N
1 – SN7420N
– SG221-03

PIN CONNECTIONS FOR A4



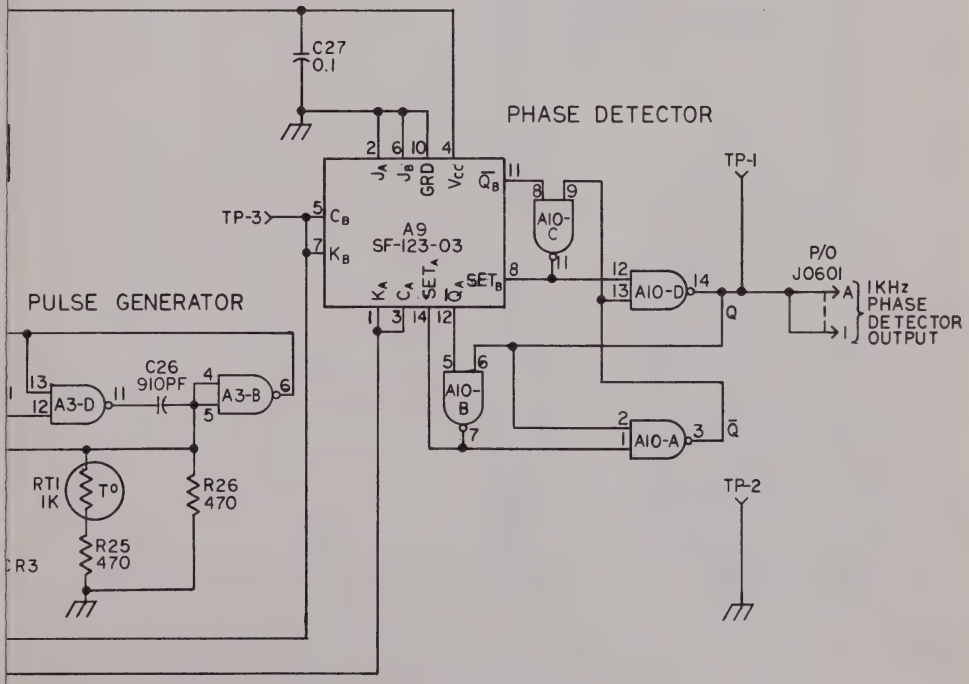



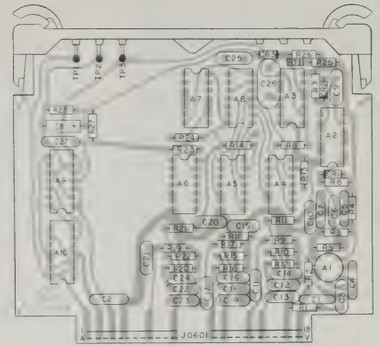

Figure 8.3 – HF Divider Assembly Circuit Diagram

## HF VCO ASSEMBLY – 724-0550

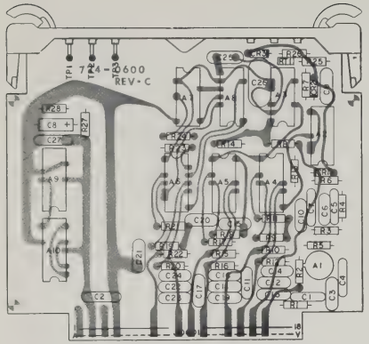
| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascode Amplifier, Type CA3028A | IC-0036 |
| A2 | Integrated Circuit, Decade Counter, Type N8280A | IC-0020 |
| C1 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C2 | Capacitor, Tantalum, Polar, 3.3 UF ±20%; 10 Vdcw | C-6305 |
| C3 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C4 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C5 | Capacitor, Tantalum, Polar, 4.7 UF ±20%; 20 Vdcw | C-6313 |
| C6 | Capacitor, Tantalum, 82 UF ±20%; 6 Vdcw | C-2172 |
| C7 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C8 | Capacitor, Tantalum, Polar, 1.0 UF ±10%; 25 Vdcw | C-6290 |
| C9 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C10 | Capacitor, Variable, 0.8-10.0 UF; 250 Vdcw | C-2175 |
| C11 | Capacitor, Tantalum, Polar, 0.22 UF ±10%; 35 Vdcw | C-6280 |
| C12 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C13 | Capacitor, Mylar, 4700 PF ±2%; 50 Vdcw | C-2180 |
| C14 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C15 | Capacitor, Mica, 330 PF ±5%; 500 Vdcw | C-0139 |
| C16 | Capacitor, Mylar, 9400 PF ±2%; 50 Vdcw | C-2181 |
| C17 | Capacitor, Tantalum, Polar, 33 UF ±20%; 10 Vdcw | C-6355 |
| C18 | Capacitor, Mylar, 4700 PF ±2%; 50 Vdcw | C-2180 |
| C19 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C20 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C21 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C22 | Capacitor, Tantalum, Polar, 4.7 UF ±20%; 20 Vdcw | C-6313 |
| C23 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C24 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C25 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C26 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C27 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C28 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C29 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C30 | Capacitor, Mica, 43 PF ±5%; 500 Vdcw | C-0116 |
| C31 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C32 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C33 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C34 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C35 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C36 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C37 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C38 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C39 | Capacitor, Tantalum, Polar, 1.0 UF ±10%; 25 Vdcw | C-6290 |
| C40 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C41 | Capacitor,Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C42 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C43 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C44 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C45 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C46 | Capacitor, Mica, 560 PF ±5%; 500 Vdcw | C-0146 |
| C47 | Capacitor, Mica, 1200 PF ±5%; 500 Vdcw | C-0154 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Voltage Variable Capacitance, Type MV1650 | CR-0095 |
| CR4 | Diode, Voltage Variable Capacitance, Type MV1650 | CR-0095 |
| CR5 | Diode, Voltage Variable Capacitance, Type MV1640 | CR-0090 |
| CR6 | Diode, Voltage Variable Capacitance, Type MV1640 | CR-0090 |
| CR7 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR8 | Diode, Zener, 8.2V ±10%, Type 1N5237B | CR-0216 |
| CR9 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR10 | Diode, Silicon, Type 1N4454 | CR-0705 |
| L1 | Coil, Rf, Molded, 39 UH | L-0635 |
| L2 | Coil, Rf, Shielded, Tunable, 1.35-1.65 UH | L-0715 |
| L3 | Coil, Rf, Molded, 470 UH | L-0648 |
| L4 | Coil, Rf, Molded, 39 UH | L-0635 |
| L5 | Coil, Rf, Molded, 33 UH | L-0634 |
| L6 | Coil, Rf, Molded, 4.7 UH | L-0624 |

## HF VCO ASSEMBLY – 724-550 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| L7 | Coil, Rf, Molded, 220 UH | L-0644 |
| L8 | Coil, Rf, Molded, 56 UH | L-0637 |
| L9 | Coil, Rf, Molded, 56 UH | L-0637 |
| L10 | Coil, Rf, Molded, 47 UH | L-0636 |
| Q1 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q2 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q3 | Transistor, Silicon, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q4 | Transistor, FET, Amplifier, Type 2N4416 | Q-0005 |
| Q5 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q6 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q7 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q8 | Transistor, MOSFET, Dual Gate, VHF Amplifier/ Mixer | Q-0325 |
| Q9 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R2 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R3 | Resistor, Carbon; 68 ohms ±10%; 1/4W | R-0010 |
| R4 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R5 | Resistor, Carbon; 680 ohms ±10%; 1/4W | R-0022 |
| R6 | Resistor, Carbon; 68K ±10%; 1/4W | R-0046 |
| R7 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R8 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R9 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R10 | Resistor, Carbon; 3300 ohms ±10%; 1/4W | R-0030 |
| R11 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R12 | Resistor, Metal Film; 16500 ohms ±1%; 1/8W | R-7287 |
| R13 | Resistor, Metal Film; 33200 ohms ±1%; 1/8W | R-7288 |
| R14 | Resistor, Metal Film; 33200 ohms ±1%; 1/8W | R-7288 |
| R15 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R16 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R17 | Resistor, Carbon; 120 ohms ±10%; 1/4W | R-0013 |
| R18 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R19 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R20 | Resistor, Carbon; 120 ohms ±10%; 1/4W | R-0013 |
| R21 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R22 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R23 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R24 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| R25 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R26 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R27 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R28 | Resistor, Carbon; 120 ohms ±10%; 1/4W | R-0013 |
| R29 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R30 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R31 | Resistor, Carbon; 120 ohms ±10%; 1/4W | R-0013 |
| R32 | Resistor, Carbon; 220 K ±10%; 1/4W | R-0052 |
| R33 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R34 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R35 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R36 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R37 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R38 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R39 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R40 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R41 | Resistor, Carbon; 8200 ohm ±10%; 1/4W | R-0035 |
| R42 | Resistor, Carbon; 3900 ohms ±10%; 1/4W | R-0031 |
| R43 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R44 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R45 | Resistor, Carbon; 680 ohms ±10%; 1/4W | R-0022 |
| — | Ejector, P.C. Board | MP-4341 |
| — | Socket, 14 pin, Dual 1 n-line | X-0107 |



A. Component Locations with Opposite Side Foil




B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

| Stage | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 0.50 V | 3.60 V | 0.00 V | 2.90 V | 7.00 V | 10.8 V | 10.8 V | 0.50 V |

*Referenced to ground.

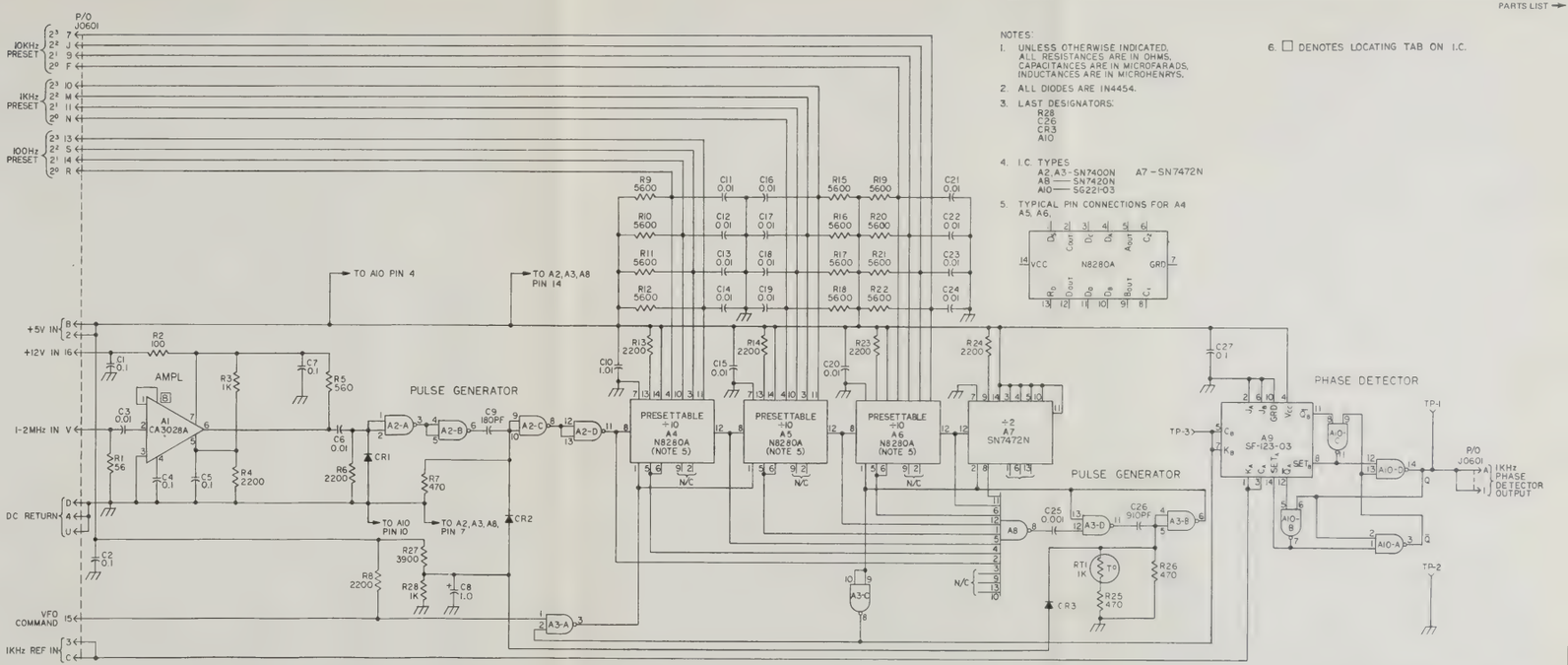
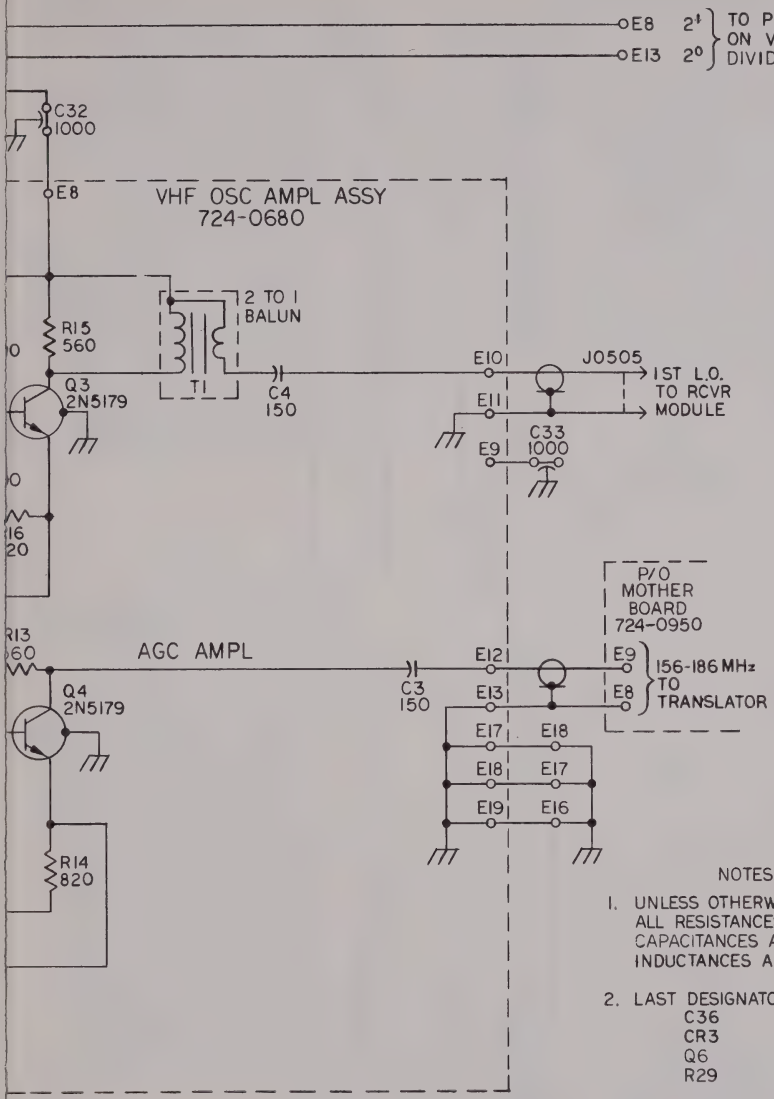

NOTES:
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
2. ALL DIODES ARE IN4454.
3. LAST DESIGNATORS: R28, C26, CR3, A10
4. I.C TYPES: A2, A3 - SN7400N; A7 - SN7472N; A8 — SN7420N; A10 — SG2203
5. TYPICAL PIN CONNECTIONS FOR A4, A5, A6.
6. ☐ DENOTES LOCATING TAB ON I.C.
P/O J0601
10KHz PRESET
1KHz PRESET
100Hz PRESET
+5V IN
+12V IN
1-2MHz IN
DC RETURN
VFO COMMAND
1KHz REF IN
TO A10 PIN 4
TO A2, A3, A8 PIN 14
AMPL
A1 CA3028A
PULSE GENERATOR
PRESETTABLE ÷10 A4 N8280A (NOTE 5)
PRESETTABLE ÷10 A5 N8280A (NOTE 5)
PRESETTABLE ÷10 A6 N8280A (NOTE 5)
÷2 A7 SN7472N
PULSE GENERATOR
PHASE DETECTOR
A9 SF-123-03
TO A10 PIN 10
TO A2, A3, A8, PIN 7
P/O J0601
1KHz PHASE DETECTOR OUTPUT
TP-1
TP-2
TP-3

Figure 8.3 — HF Divider Assembly Circuit Diagram

PARTS LIST →




NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN PICOFARADS, INDUCTANCES ARE IN MICROHENRYS.

2. LAST DESIGNATORS - 724-0660 ASSY
   C36
   CR3
   Q6
   R29

3. LAST DESIGNATORS - 724-0670 ASSY
   C9
   CR6
   Q3
   R9
   L3

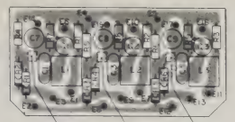
4. LAST DESIGNATORS 724 0680 ASSY
   C4

   Q4
   R16
   T1

Figure 8.4 — VHF VCO Assembly Circuit Diagram

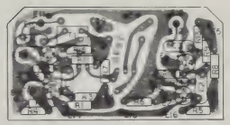
## HF DIVIDER ASSEMBLY – 724-0600

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A | IC-0036 |
| A2 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A3 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A4 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A5 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A6 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A7 | Integrated Circuit, Flip Flop, Type SN7472N | IC-0016 |
| A8 | Integrated Circuit, NAND Gate, Type SN7430N | IC-0014 |
| A9 | Integrated Circuit, Flip Flop, Type SF123-03 | IC-0023 |
| A10 | Integrated Circuit, NAND Gate, Type SG223-03 | IC-0024 |
| C1 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C2 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C3 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C4 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C5 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C6 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C7 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C8 | Capacitor, Tantalum, Polar, 1.0 UF ±20%; 25 Vdcw | C-6291 |
| C9 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C10 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C11 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C12 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C13 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C14 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C15 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C16 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C17 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C18 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C19 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C20 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C21 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C22 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C23 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C24 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C25 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C26 | Capacitor, Mica, 910 PF ±5%; 500 Vdcw | C-0151 |
| C27 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| R1 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R2 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R3 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R4 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R5 | Resistor, Carbon; 560 ohms ±10%; 1/4W | R-0021 |
| R6 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R7 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R8 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R9 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R10 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R11 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R12 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R13 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R14 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R15 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R16 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R17 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R18 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R19 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R20 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R21 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R22 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R23 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R24 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R25 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R26 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R27 | Resistor, Carbon; 3900 ohms ±10%; 1/4W | R-0031 |
| R28 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| RT1 | Thermistor, Disk, 1K ±10% | R-3167 |
| — | Ejector, P.C. Board, with jacks | MP-4340 |
| — | Socket, 14 pin, Dual In-line | X-0107 |

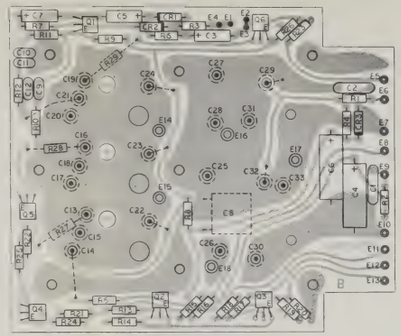


NOTE: C2, C4, & C6 SOLDERED TO WIRING SIDE

C. 724-0670 Assembly Component Locations with Opposite Side Foil

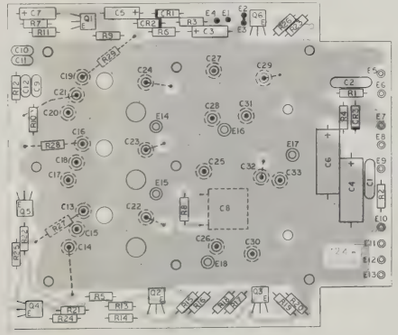


D. 724-0680 Assembly Component Locations with Opposite Side Foil



NOTE: COMPONENTS & JUMPERS IN DOTTED LINES TO BE MOUNTED ON WIRING SIDE

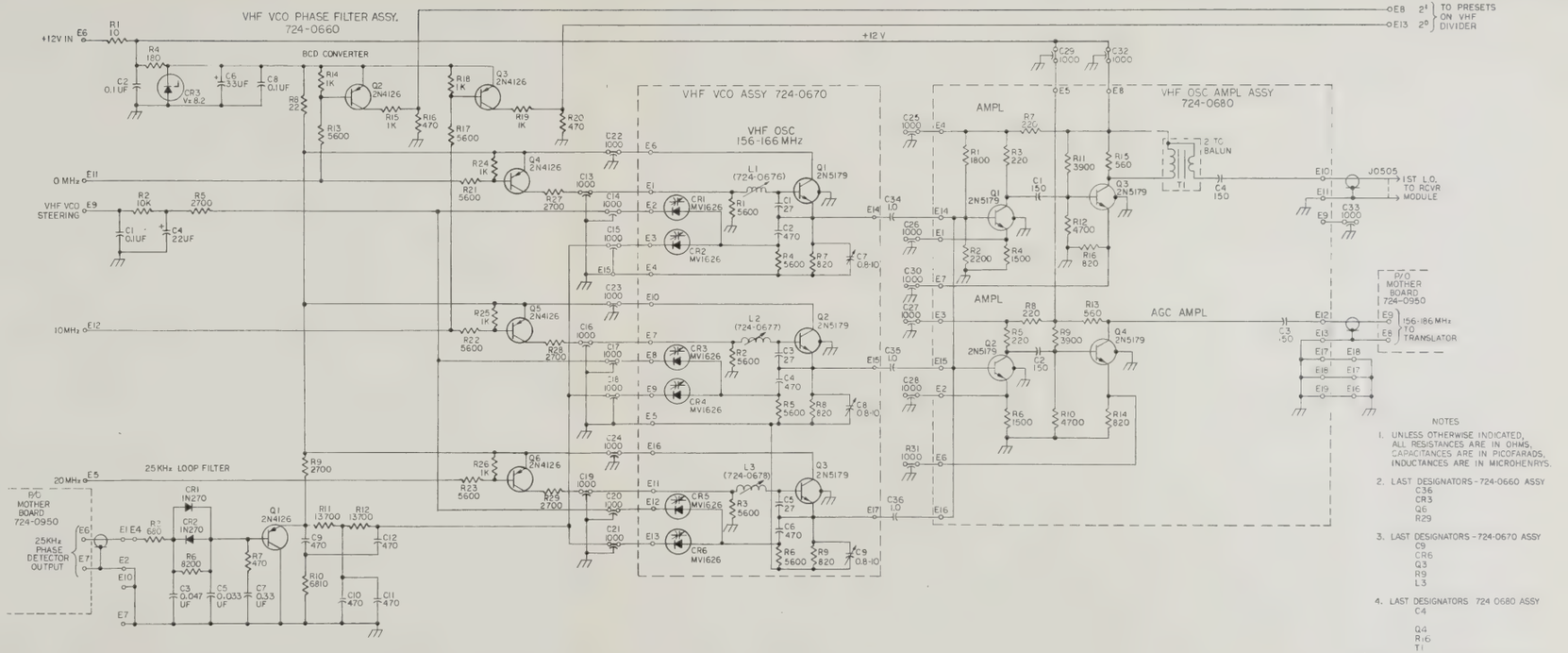
A. 724-0660 Assembly Component Locations with Opposite Side Foil



NOTE: COMPONENTS & JUMPERS IN DOTTED LINES TO BE MOUNTED ON WIRING SIDE

B. 724-0660 Component Locations with Adjacent Side Foil

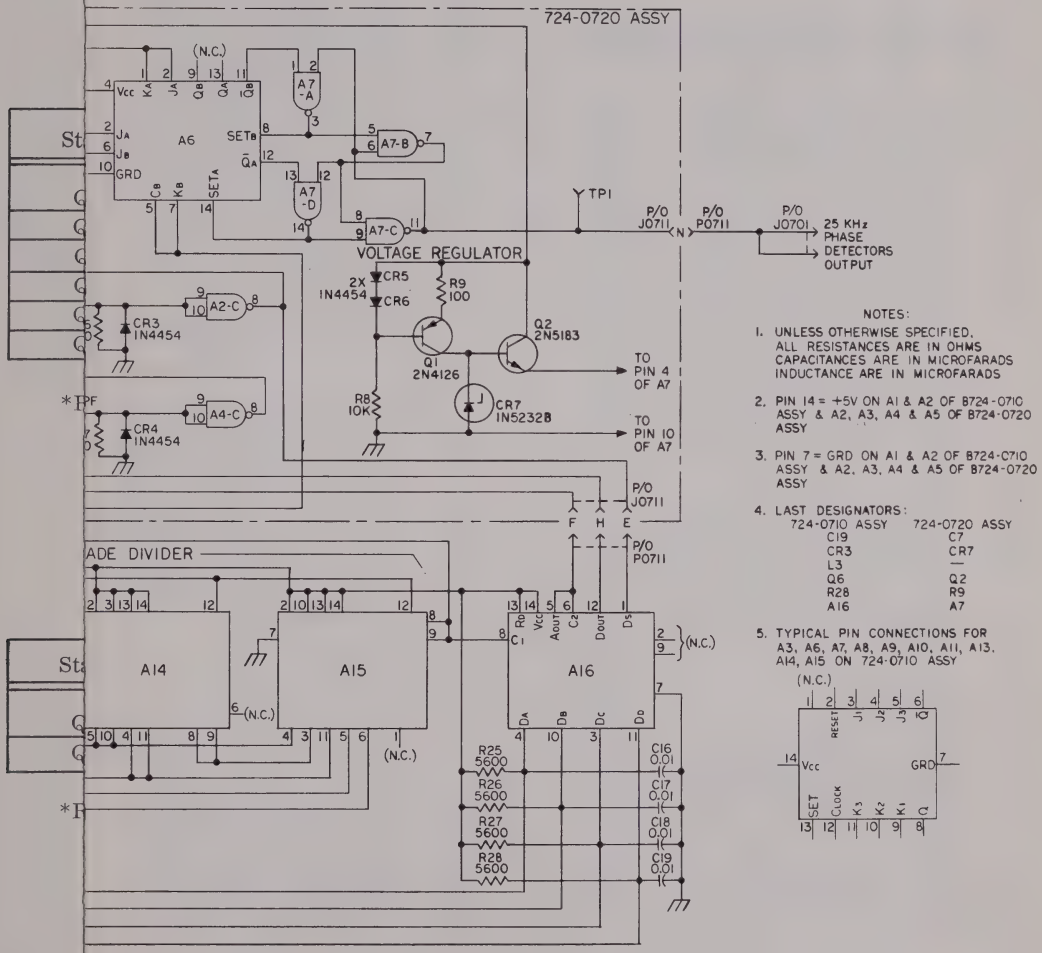





NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN PICOFARADS, INDUCTANCES ARE IN MICROHENRYS.
2. LAST DESIGNATORS - 724-0660 ASSY
   C36
   CR3
   Q6
   R29
3. LAST DESIGNATORS - 724-0670 ASSY
   C9
   CR6
   Q3
   R9
   L3
4. LAST DESIGNATORS 724 0680 ASSY
   C4
   Q4
   R16
   T1

Figure 8.4 – VHF VCO Assembly Circuit Diagram




NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS CAPACITANCES ARE IN MICROFARADS INDUCTANCE ARE IN MICROFARADS
2. PIN 14 = +5V ON A1 & A2 OF 8724-0710 ASSY & A2, A3, A4 & A5 OF 8724-0720 ASSY
3. PIN 7 = GRD ON A1 & A2 OF 8724-0710 ASSY & A2, A3, A4 & A5 OF 8724-0720 ASSY
4. LAST DESIGNATORS:

| 724-0710 ASSY | 724-0720 ASSY |
|---|---|
| C19 | C7 |
| CR3 | CR7 |
| L3 | — |
| Q6 | Q2 |
| R28 | R9 |
| A16 | A7 |

5. TYPICAL PIN CONNECTIONS FOR A3, A6, A7, A8, A9, A10, A11, A13, A14, A15 ON 724-0710 ASSY




Figure 8.5 – VHF Divider Assembly Circuit Diagram

## VHF VCO ASSEMBLY – 724-0650

| Reference Designation | Description | RF P/N |
|---|---|---|
| C13 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C 4327 |
| C14 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C15 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C16 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C17 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C18 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C19 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C20 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C21 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C22 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C23 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C24 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C25 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C26 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C27 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C28 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C29 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C30 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C31 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C32 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C33 | Capacitor, Feed-thru, 1000 PF ±20%; 500 Vdcw | C-4327 |
| C34 | Capacitor, Ceramic, 1 PF ±5% | C-4608 |
| C35 | Capacitor, Ceramic, 1 PF ±5% | C-4608 |
| C36 | Capacitor, Ceramic, 1 PF ±5% | C-4608 |
| J0505 | Connector, Coaxial, Male | J-0033 |
| | VHF VCO PHASE FILTER SUB-ASSEMBLY | 724-0660 |
| | VHF VCO BOARD SUB-ASSEMBLY | 724-0670 |
| | VHF OSCILLATOR AMPLIFIER SUB-ASSEMBLY | 724-0680 |

## VHF VCO PHASE FILTER SUB-ASSEMBLY – 724-0660

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C2 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C3 | Capacitor, Tantalum, Polar, 0.047 UF ±10%; 35 Vdcw | C-6272 |
| C4 | Capacitor, Tantalum, Polar, 22 UF ±20%; 15 Vdcw | C-6353 |
| C5 | Capacitor, Tantalum, Polar, 0.033 UF ±10%; 35 Vdcw | C-6270 |
| C6 | Capacitor, Tantalum, Polar, 33 UF ±20%; 10 Vdcw | C-6355 |
| C7 | Capacitor, Tantalum, Polar, 0.33 UF ±10%; 35 Vdcw | C-6282 |
| C8 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C9 | Capacitor, Silver Mica, 470 PF ±2% | C-2179 |
| C10 | Capacitor, Silver Mica, 470 PF ±2% | C-2179 |
| C11 | Capacitor, Silver Mica, 470 PF ±2% | C-2179 |
| C12 | Capacitor, Silver Mica, 470 PF ±2% | C-2179 |
| CR1 | Diode, Type 1N270 | CR-0047 |
| CR2 | Diode, Type 1N270 | CR-0047 |
| CR3 | Diode, Zener, 8.2V ±10%; Type 1N5237 | CR-0216 |
| Q1 | Transistor, Silicon, General Purpose PNP, Type 2N4126 | Q-0386 |
| Q2 | Transistor, Silicon, General Purpose PNP, Type 2N4126 | Q-0386 |
| Q3 | Transistor, Silicon, General Purpose PNP, Type 2N4126 | Q-0386 |
| Q4 | Transistor, Silicon, General Purpose PNP, Type 2N4126 | Q-0386 |
| Q5 | Transistor, Silicon, General Purpose PNP, Type 2N4126 | Q-0386 |
| Q6 | Transistor, Silicon, General Purpose PNP, Type 2N4126 | Q-0386 |
| R1 | Resistor, Carbon; 10 ohms ±10%; 1/4W | R-0000 |
| R2 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R3 | Resistor, Carbon; 680 ohms ±10%; 1/4W | R-0022 |
| R4 | Resistor, Carbon; 180 ohms ±10%; 1/4W | R-0015 |
| R5 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R6 | Resistor, Carbon; 8200 ohms ±10%; 1/4W | R-0035 |
| R7 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R8 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R9 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R10 | Resistor, Metal Film; 6810 ohms ±1%; 1/8W | R-7285 |
| R11 | Resistor, Metal Film; 13700 ohms ±1%; 1/8W | R-7286 |
| R12 | Resistor, Metal Film; 13700 ohms ±1%; 1/8W | R-7286 |
| R13 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R14 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R15 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R16 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R17 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R18 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R19 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R20 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R21 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R22 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R23 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R24 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R25 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R26 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |

## VHF VCO BOARD SUB-ASSEMBLY – 724-0670

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Disk, 25 PF ±5%; 1000 Vdcw | C-2188 |
| C2 | Capacitor, VHF, 470 PF ±20% | C-1191 |
| C3 | Capacitor, Disk, 25 PF ±5%; 1000 Vdcw | C-2188 |
| C4 | Capacitor, VHF, 470 PF ±20% | C-1191 |
| C5 | Capacitor, Disk, 25 PF ±5%; 1000 Vdcw | C-2188 |
| C6 | Capacitor, VHF, 470 PF ±20% | C-1191 |
| CR1 | Diode, Varactor, Type MV1626 | CR-0083 |
| CR2 | Diode, Varactor, Type MV1626 | CR-0083 |
| CR3 | Diode, Varactor, Type MV1626 | CR-0083 |
| CR4 | Diode, Varactor, Type MV1626 | CR-0083 |
| CR5 | Diode, Varactor, Type MV1626 | CR-0083 |
| CR6 | Diode, Varactor, Type MV1626 | CR-0083 |
| L1 | Coil, VHF, Close Wound #28 enamel 1 1/2 turns | 724-0676 |
| L2 | Coil, VHF, Close Wound #24 enamel 1 1/2 turns | 724-0677 |
| L3 | Coil, VHF, Close Wound #24 enamel 1 1/4 turns | 724-0678 |
| Q1 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q2 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q3 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| R1 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R2 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R3 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R4 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R5 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R6 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R7 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R8 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R9 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |

## VHF OSCILLATOR AMPLIFIER SUB-ASSEMBLY 724-0680

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw | C-2263 |
| C2 | Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw | C-2263 |
| C3 | Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw | C-2263 |
| C4 | Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw | C-2263 |
| Q1 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q2 | Transistor, Silicon, UEF, NPN, Type 2N5179 | Q-0390 |
| Q3 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q4 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| R1 | Resistor, Carbon; 1800 ohms ±10%; 1/4W | R-0027 |
| R2 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R3 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R4 | Resistor, Carbon; 1500 ohms ±10%; 1/4W | R-0026 |
| R5 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R6 | Resistor, Carbon; 1500 ohms ±10%; 1/4W | R-0026 |
| R7 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R8 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R9 | Resistor, Carbon; 3900 ohms ±10%; 1/4W | R-0031 |
| R10 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R11 | Resistor, Carbon; 3900 ohms ±10%; 1/4W | R-0031 |
| R12 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R13 | Resistor, Carbon; 560 ohms ±10%; 1/4W | R-0021 |
| R14 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R15 | Resistor, Carbon; 560 ohms ±10%; 1/4W | R-0021 |
| R16 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| T1 | Transformer, Balun, 50 ohms to 200 ohms | 724-0672 |

724-0710 ASSEMBLY

DC VOLTAGES*

| Stage | E | B | C |
|---|---|---|---|
| Q1 | 0.00 V | 0.69 V | 1.31 V |
| Q2 | 1.45 V | 1.31 V | 4.80 V |
| Q3 | 0.00 V | 0.69 V | 3.50 V |
| Q4 | 3.40 V | 3.50 V | 10.5 V |
| Q5 | 1.70 V | 2.20 V | 5.00 V |
| Q6 | 1.60 V | 1.00 V | 0.00 V |

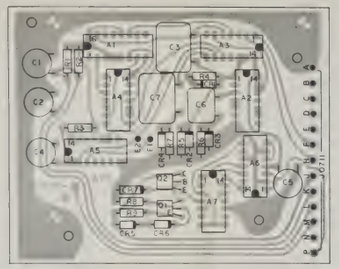
*Referenced to ground.

724-0720 ASSEMBLY

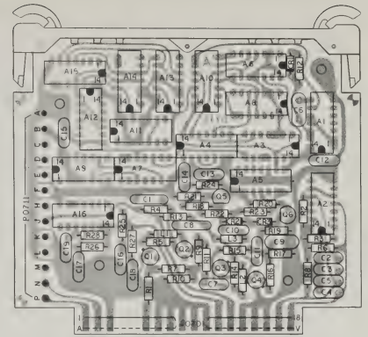
DC VOLTAGES*

| Stage | E | B | C |
|---|---|---|---|
| Q1 | 11.9 V | 10.5 V | 5.30 V |
| Q2 | 4.70 V | 5.30 V | 11.5 V |

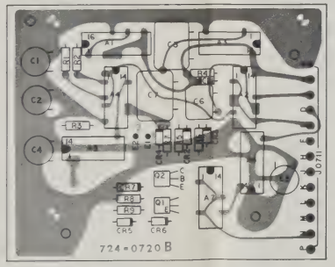
*Referenced to ground.



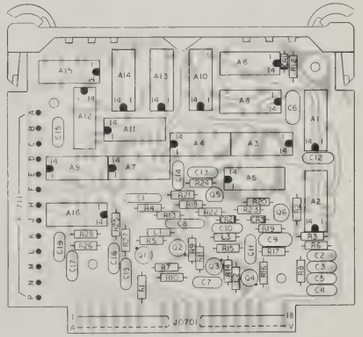
C. 724-0720 Assembly Component Locations with Opposite Side Foil



A. 724-0710 Assembly Component Locations with Opposite Side Foil




D. 724-0720 Assembly Component Locations with Adjacent Side Foil



B. 724-0710 Assembly Component Locations with Adjacent Side Foil

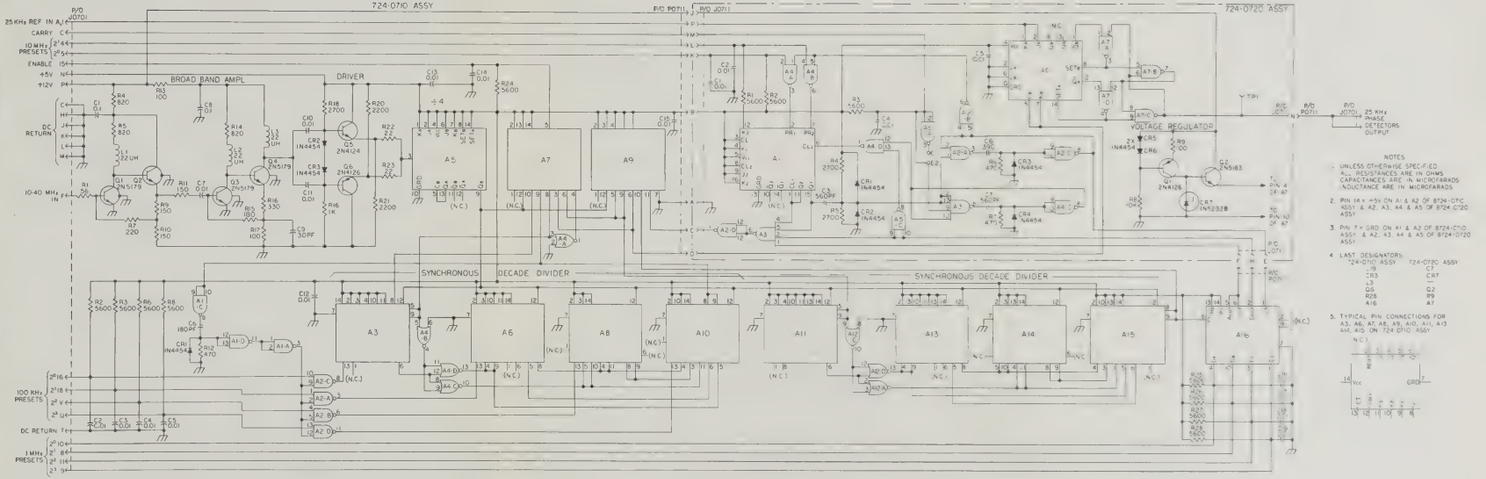

724-0710 ASSY
724-0720 ASSY
BROAD BAND AMPL
DRIVER
SYNCHRONOUS DECADE DIVIDER
VOLTAGE REGULATOR
NOTES
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS CAPACITANCES ARE IN MICROFARADS INDUCTANCE ARE IN MICROFARADS
2. PIN 14 = +5V ON A1 & A2 OF 8724-0710 ASSY & A2, A3, A4 & A5 OF 8724-0720 ASSY
3. PIN 7 = GRD ON A1 & A2 OF 8724-0710 ASSY & A2, A3, A4 & A5 OF 8724-0720 ASSY
4. LAST DESIGNATORS
5. TYPICAL PIN CONNECTIONS FOR A3, A6, A7, A8, A9, A10, A11, A13 A14, A15 ON 724-0710 ASSY

Figure 8.5 – VHF Divider Assembly Circuit Diagram

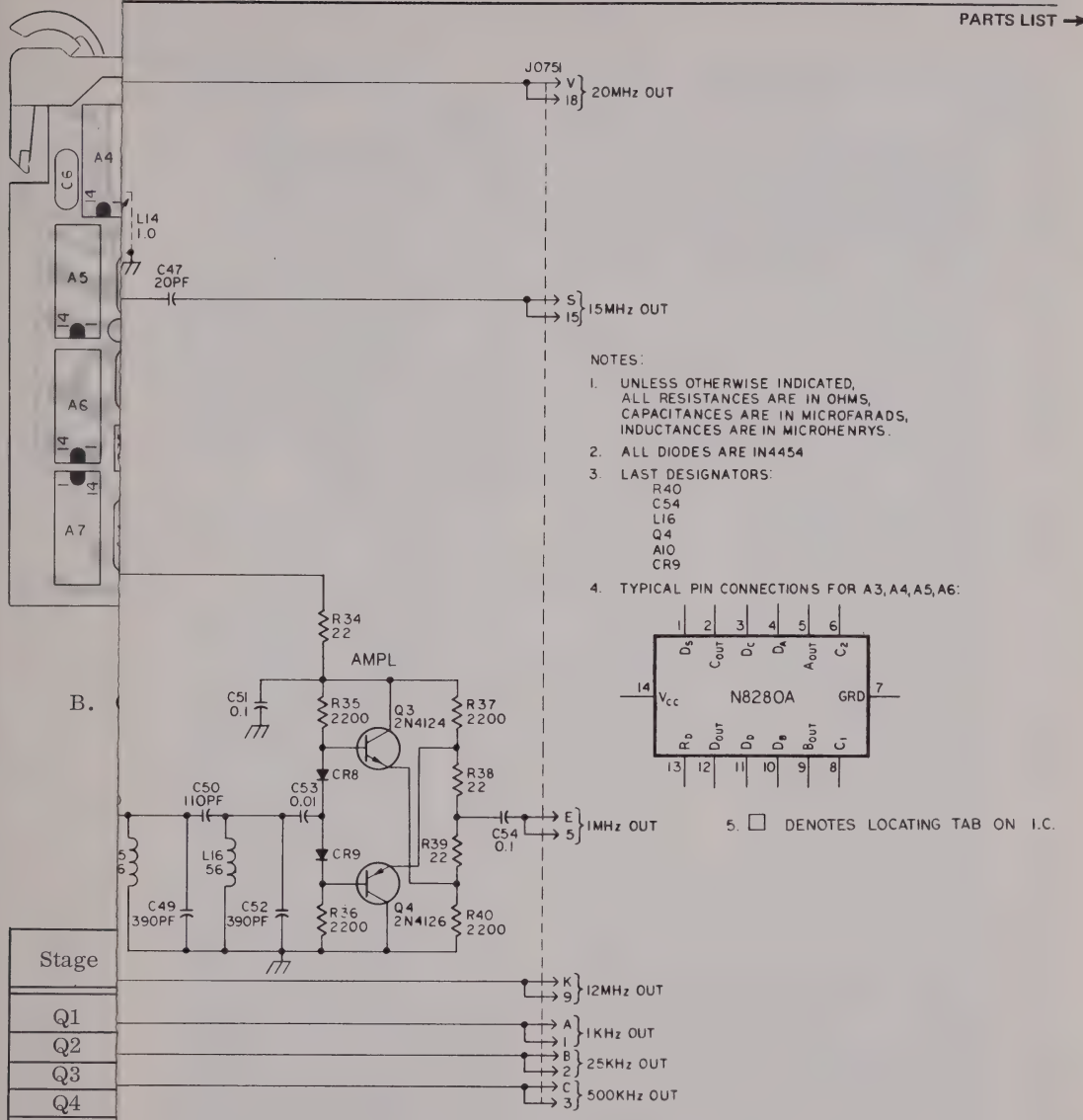



Figure 8.6 — Spectrum Generator Assembly Circuit Diagram



* Refer

## VHF DIVIDER ASSEMBLY – 724-0700

| Reference Designation | Description | RF P/N |
|---|---|---|
| | VHF DIVIDER BOARD NO. 1 SUB-ASSEMBLY | 724-0710 |
| | VHF DIVIDER BOARD NO. 2 SUB-ASSEMBLY | 724-0720 |

## VHF DIVIDER BOARD NO. 1 SUB-ASSEMBLY 724-0710

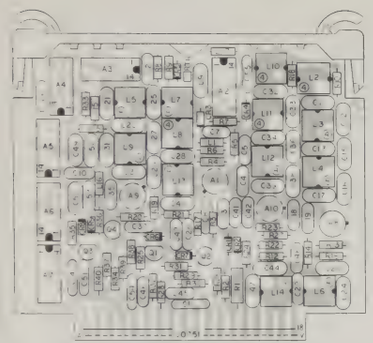
| | | |
|---|---|---|
| A1 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A2 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A3 | Integrated Circuit, Flip Flop, Type SN74H72N | IC-0019 |
| A4 | Integrated Circuit, NOR Gate, Type SN7402N | IC-0011 |
| A5 | Integrated Circuit, Dual Flip Flop, Type SF123-03 | IC-0023 |
| A6 | Integrated Circuit, Flip Flop, Type SN7472N | IC-0016 |
| A7 | Integrated Circuit, Flip Flop, Type SN74H72N | IC-0019 |
| A8 | Integrated Circuit, Flip Flop, Type SN7472N | IC-0016 |
| A9 | Integrated Circuit, Flip Flop, Type SN74H72N | IC-0019 |
| A10 | Integrated Circuit, Flip Flop, Type SN74H72N | IC-0019 |
| A11 | Integrated Circuit, Flip Flop, Type SN74H72N | IC-0019 |
| A12 | Integrated Circuit, NOR Gate, Type SN7402N | IC-0011 |
| A13 | Integrated Circuit, Flip Flop, Type SN7472N | IC-0016 |
| A14 | Integrated Circuit, Flip Flop, Type SN7472N | IC-0016 |
| A15 | Integrated Circuit, Flip Flop, Type SN74H72N | IC-0019 |
| A16 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| C1 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C2 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C3 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C5 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C6 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C7 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C8 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C9 | Capacitor, Mica, 30 PF ±5%; 500 Vdcw | C-0112 |
| C10 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C11 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C12 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C13 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C14 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C15 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C16 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C17 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C18 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C19 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| L1 | Coil, Rf, 22.0 UH | L-0632 |
| L2 | Coil, Rf, 22.0 UH | L-0632 |
| L3 | Coil, Rf, 22.0 UH | L-0632 |
| P-0711 | Connector, Elco, 13 pin | MP-1428 |
| Q1 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q2 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q3 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q4 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| Q5 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q6 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| R1 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R2 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R3 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |

## VHF DIVIDER BOARD NO. 1 SUB-ASSEMBLY 724-0710 (Cont.)

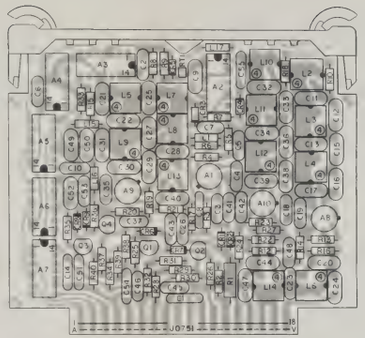
| Reference Designation | Description | RF P/N |
|---|---|---|
| R4 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R5 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R6 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R7 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R8 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R9 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R10 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R11 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R12 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R13 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R14 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R15 | Resistor, Carbon; 180 ohms ±10%; 1/4W | R-0015 |
| R16 | Resistor, Carbon; 330 ohms ±10%; 1/4W | R-0018 |
| R17 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R18 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R19 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R20 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R21 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R22 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R23 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R24 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R25 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R26 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R27 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R28 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| — | Ejector, P.C. Board, with jacks | MP-4340 |

## VHF DIVIDER BOARD NO.2 SUB-ASSEMBLY 724-0720

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Flip Flop, Type SN7476N | IC-0017 |
| A2 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A3 | Integrated Circuit, NAND Gate, Type SN7420N | IC-0013 |
| A4 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A5 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A6 | Integrated Circuit, Flip Flop, Type SF123-03 | IC-0023 |
| A7 | Integrated Circuit, NAND Gate, Type SG223-03 | IC-0024 |
| C1 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C2 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C3 | Capacitor, Mica, 560 PF ±5%; 500 Vdcw | C-0146 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C5 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C6 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C7 | Capacitor, Mica, 560 PF ±5%; 500 Vdcw | C-0146 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR7 | Diode, Zener, 5.6V ±5%; Type 1N5232B | CR-0262 |
| J-0711 | Connector, Elco, 13 pin | MP-1428 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N5183 | Q-0006 |
| Q2 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| R1 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R2 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R3 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R4 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R5 | Resistor, Carbon, 2700 ohms ±10%; 1/4W | R-0029 |
| R6 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R7 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R8 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R9 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |



B. Component Locations with Adjacent Side Foil



A. Component Locations with Opposite Side Foil

DC VOLTAGES*

| Stage | E | B | C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q1 | 2.45 V | 3.10 V | 5.00 V | | | | | | | | | | | |
| Q2 | 2.45 V | 1.90 V | 0.00 V | | | | | | | | | | | |
| Q3 | 2.50 V | 3.10 V | 5.00 V | | | | | | | | | | | |
| Q4 | 2.50 V | 1.95 V | 0.00 V | | | | | | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 | Pin 11 | Pin 12 | Pin 13 | Pin 14 |
| A1 | 0.20 V | 3.40 V | 0.00 V | 2.80 V | 6.50 V | 9.90 V | 10.0 V | 0.20 V | | | | | | |
| A2 | 0.51 V | 0.51 V | 3.00 V | 3.00 V | 1.30 V | 2.10 V | 0.00 V | 1.30 V | 2.80 V | 2.80 V | 0.42 V | 3.00 V | 3.00 V | 4.80 V |
| A3 | 5.00 V | 0.00 V | 0.00 V | 0.00 V | 1.90 V | 1.30 V | 0.00 V | 0.71 V | 0.00 V | 0.00 V | 0.00 V | 0.84 V | 5.00 V | 5.00 V |
| A4 | 5.00 V | 0.00 V | 0.00 V | 0.00 V | 1.90 V | 1.90 V | 0.00 V | 1.90 V | 0.00 V | 0.00 V | 0.00 V | 0.87 V | 5.00 V | 5.00 V |
| A5 | 5.00 V | 0.00 V | 0.00 V | 0.00 V | 1.90 V | 0.87 V | 0.00 V | 0.87 V | 0.00 V | 0.00 V | 0.00 V | 0.84 V | 5.00 V | 5.00 V |
| A6 | 5.00 V | 0.00 V | 0.00 V | 0.00 V | 1.90 V | 1.90 V | 0.00 V | 0.84 V | 0.00 V | 0.00 V | 0.00 V | 0.85 V | 5.00 V | 5.00 V |
| A7 | 1.90 V | 1.90 V | 2.30 V | 0.85 V | 0.85 V | 3.20 V | 0.00 V | 1.80 V | 1.90 V | 1.90 V | 0.00 V | 0.00 V | 0.00 V | 5.00 V |
| A8 | 6.00 V | 3.30 V | 0.00 V | 2.60 V | 6.80 V | 9.90 V | 9.90 V | 0.00 V | | | | | | |
| A9 | 6.00 V | 3.40 V | 0.00 V | 2.60 V | 6.80 V | 9.90 V | 9.90 V | 0.00 V | | | | | | |
| A10 | 6.00 V | 3.40 V | 0.00 V | 2.60 V | 6.80 V | 9.90 V | 9.90 V | 0.00 V | | | | | | |

* Referenced to ground.

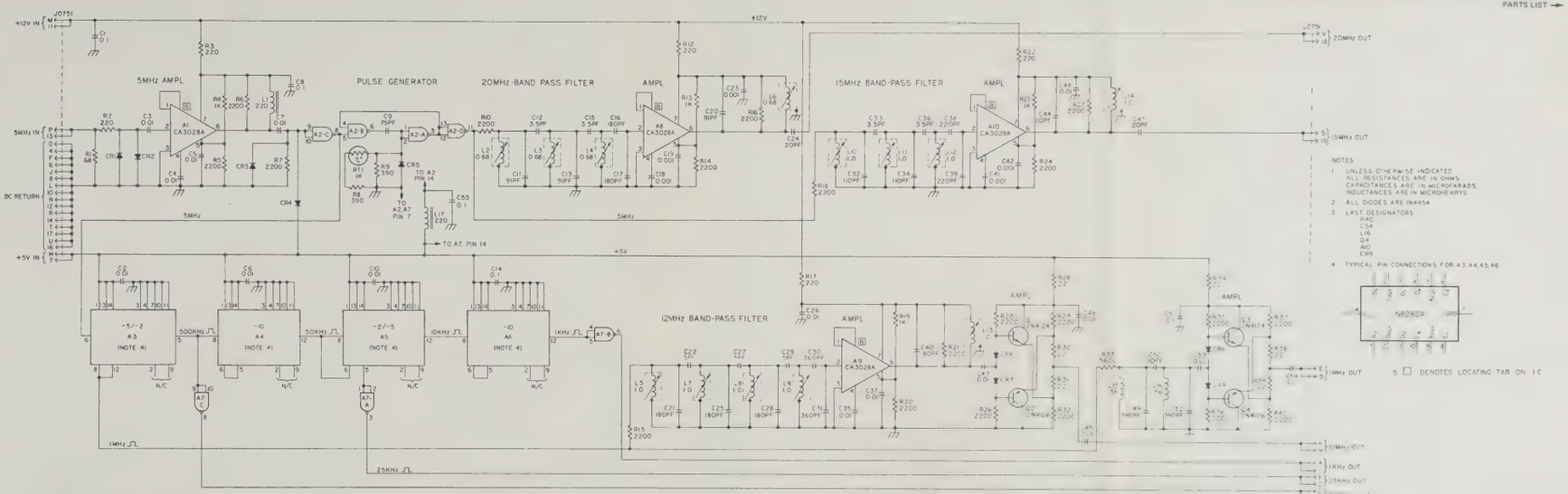
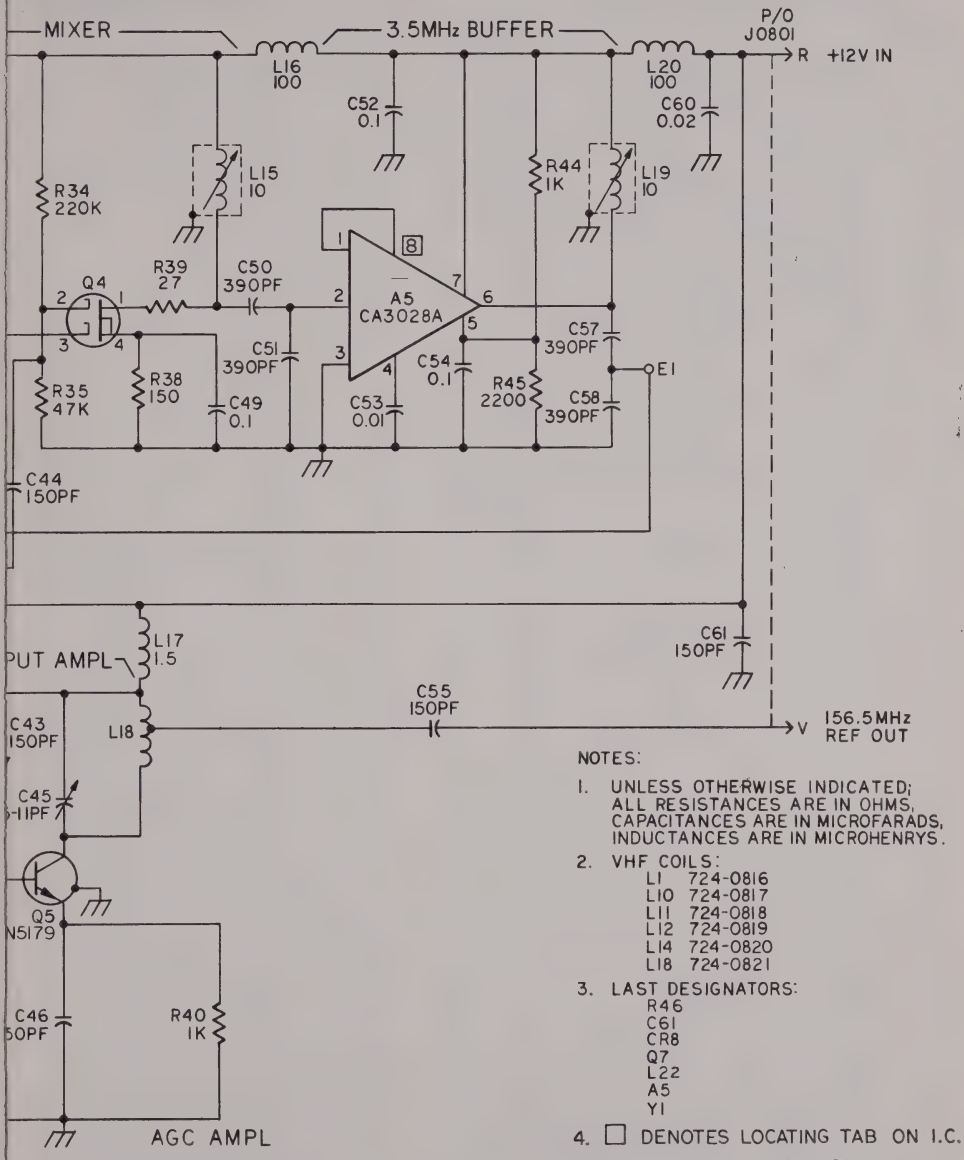



Figure 8.6 — Spectrum Generator Assembly Circuit Diagram

PARTS LIST →




NOTES:

1. UNLESS OTHERWISE INDICATED; ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
2. VHF COILS:
   - L1 724-0816
   - L10 724-0817
   - L11 724-0818
   - L12 724-0819
   - L14 724-0820
   - L18 724-0821
3. LAST DESIGNATORS:
   - R46
   - C61
   - CR8
   - Q7
   - L22
   - A5
   - Y1
4. ☐ DENOTES LOCATING TAB ON I.C.
5. Q4, RF PT. NO. Q-0325.

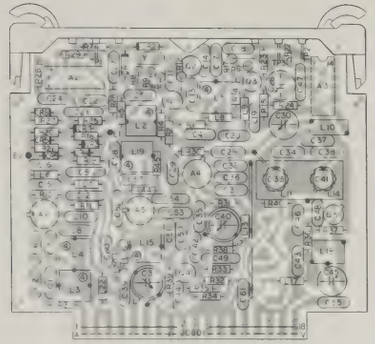
Figure 8.7 — Second L.O. Generator Assembly Circuit Diagram

## SPECTRUM GENERATOR ASSEMBLY – 724-0750

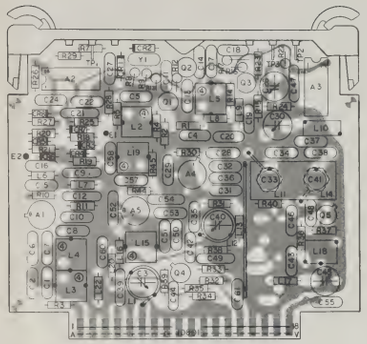
| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A | IC-0036 |
| A2 | Integrated Circuit, NAND Gate, Type SN74H00N | IC-0018 |
| A3 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A4 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A5 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A6 | Integrated Circuit, Counter/Storage, Type N8280A | IC-0020 |
| A7 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A8 | Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A | IC-0036 |
| A9 | Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A | IC-0036 |
| A10 | Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A | IC-0036 |
| C1 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C2 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C3 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C5 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C6 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C7 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C8 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C9 | Capacitor, Mica, 75 PF ±5%; 500 Vdcw | C-0123 |
| C10 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C11 | Capacitor, Mica, 91 PF ±5%; 500 Vdcw | C-0125 |
| C12 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C13 | Capacitor, Mica, 91 PF ±5%; 500 Vdcw | C-0125 |
| C14 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C15 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C16 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C17 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C18 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C19 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C20 | Capacitor, Mica, 91 PF ±5%; 500 Vdcw | C-0125 |
| C21 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C22 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C23 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C24 | Capacitor, Mica, 20 PF ±5%; 500 Vdcw | C-0108 |
| C25 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C26 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C27 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C28 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C29 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C30 | Capacitor, Mica, 360 PF ±5%; 500 Vdcw | C-0140 |
| C31 | Capacitor, Mica, 360 PF ±5%; 500 Vdcw | C-0140 |
| C32 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C33 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C34 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C35 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C36 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C37 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C38 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C39 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C40 | Capacitor, Mica, 180 PF ±5%; 500 Vdcw | C-0132 |
| C41 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C42 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C43 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C44 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C45 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C46 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C47 | Capacitor, Mica, 20 PF ±5%; 500 Vdcw | C-0108 |
| C48 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C49 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C50 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C51 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C52 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C53 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C54 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C55 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |

## SPECTRUM GENERATOR ASSEMBLY 724-0750 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR7 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR8 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR9 | Diode, Silicon, Type 1N4454 | CR-0705 |
| L1 | Coil, Rf, 220 UH | L-0644 |
| L2 | Coil, Shielded, Tunable, 0.612-0.748 UH | L-0711 |
| L3 | Coil, Shielded, Tunable, 0.612-0.748 UH | L-0711 |
| L4 | Coil, Shielded, Tunable, 0.612-0.748 UH | L-0711 |
| L5 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L6 | Coil, Shielded, Tunable, 0.612-0.748 UH | L-0711 |
| L7 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L8 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L9 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L10 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L11 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L12 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L13 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L14 | Coil, Shielded, Tunable, 0.900-1.100 UH | L-0713 |
| L15 | Coil, Rf, 56 UH | L-0637 |
| L16 | Coil, Rf, 56 UH | L-0637 |
| L17 | Coil, Rf, 220 UH | L-0644 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q3 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q4 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| R1 | Resistor, Carbon; 68 ohms ±10%; 1/2W | R-0110 |
| R2 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R3 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R4 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R5 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R6 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R7 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R8 | Resistor, Carbon; 390 ohms ±10%; 1/4W | R-0019 |
| R9 | Resistor, Carbon; 390 ohms ±10%; 1/4W | R-0019 |
| R10 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R12 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R13 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R14 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R15 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R16 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R17 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R18 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R19 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R20 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R21 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R22 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R23 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R24 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R25 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R26 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R27 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R28 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R29 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R30 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R31 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R32 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R33 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R34 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R35 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R36 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R37 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R38 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R39 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R40 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| RT1 | Thermistor, Disk, 1K ±10% | R-3167 |
| — | Ejector, P.C. Board | MP-4341 |
| — | Socket, 14 pin, Dual In-line | X-0107 |



B. Component Locations with Adjacent Side Foil



A. Component Locations with Opposite Side Foil

DC VOLTAGES *

| Stage | E | B | C |
|---|---|---|---|
| Q1 | 4.20 V | 1.50 V | 11.5 V |
| Q2 | 1.50 V | 1.50 V | 11.5 V |
| Q3 | 5.90 V | 5.70 V | 11.5 V |
| Q5 | 5.30 V | 6.00 V | 12.0 V |
| Q6 | 5.30 V | 0.00 V | 12.0 V |
| Q7 | 11.4 V | 10.9 V | 0.00 V |

| | Pin 1 | Pin 2 | Pin 3 | Pin 4 |
|---|---|---|---|---|
| Q4 | 11.5 V | 2.10 V | 1.10 V | 1.20 V |

| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 | Pin 11 | Pin 12 | Pin 13 | Pin 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0.16 V | 3.80 V | 0.00 V | 3.00 V | 7.90 V | 12.0 V | 12.0 V | 0.16 V | | | | | | |
| A2 | 1.70 V | 4.90 V | 1.40 V | 2.20 V | 4.90 V | 1.40 V | 0.00 V | 2.70 V | 2.50 V | 1.00 V | 1.00 V | 2.70 V | 2.50 V | 4.90 V |
| A3 | 2.10 V | 4.90 V | 1.60 V | 0.00 V | 4.90 V | 2.20 V | 0.00 V | 1.50 V | 2.20 V | 2.20 V | 0.00 V | 1.70 V | 1.70 V | 4.90 V |
| A4 | 0.75 V | 0.00 V | 6.00 V | 0.75 V | 0.00 V | 9.80 V | 0.00 V | 5.90 V | 11.6 V | 5.10 V | | | | |
| A5 | 0.00 V | 4.60 V | 5.00 V | 3.30 V | 6.50 V | 12.0 V | 12.0 V | 0.00 V | | | | | | |

* Referenced to ground.

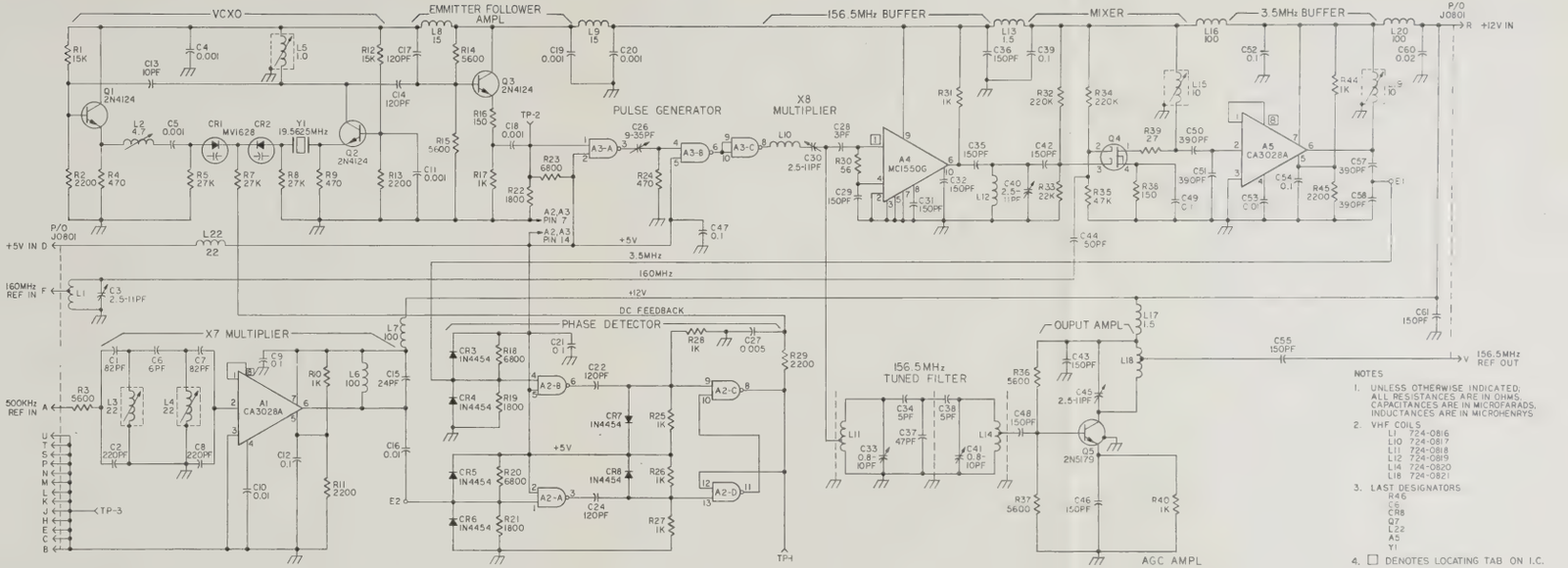
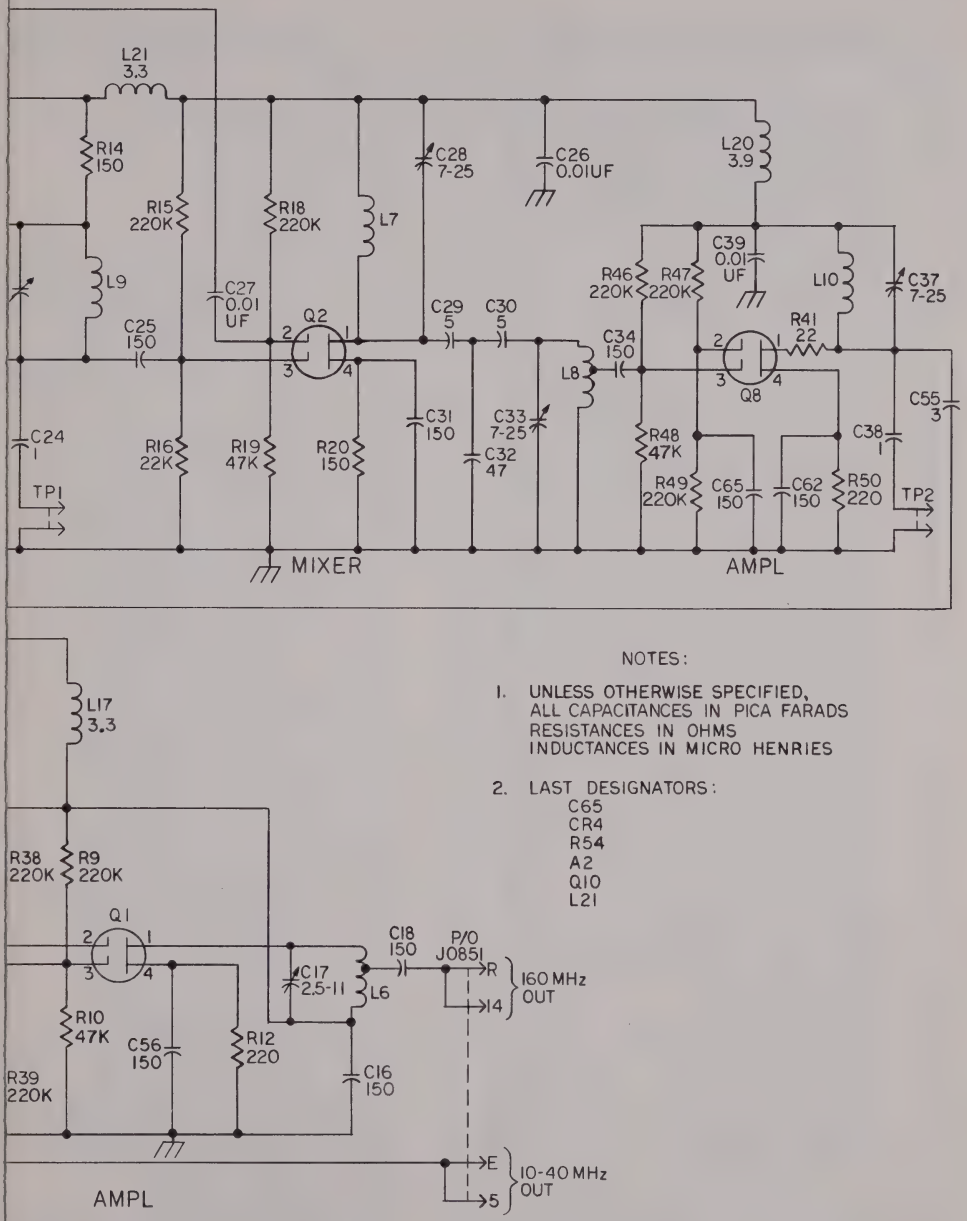



Figure 8.7 — Second L.O. Generator Assembly Circuit Diagram




NOTES:

1. UNLESS OTHERWISE SPECIFIED,
   ALL CAPACITANCES IN PICA FARADS
   RESISTANCES IN OHMS
   INDUCTANCES IN MICRO HENRIES

2. LAST DESIGNATORS:
   C65
   CR4
   R54
   A2
   Q10
   L21

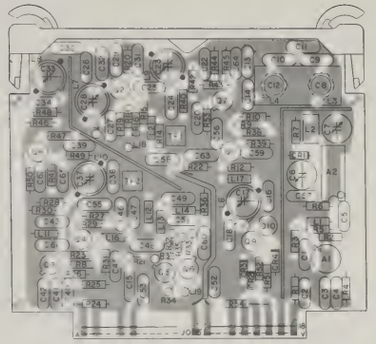
Figure 8.8 – Translator Assembly Circuit Diagram

## SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY – 724-0800

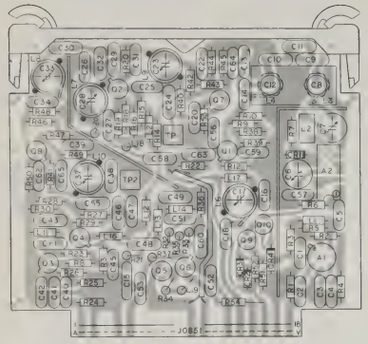
| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascade Amplifier Type CA3028A | IC-0036 |
| A2 | Integrated Circuit, NAND Gate, Type SN7400N | IC-0010 |
| A3 | Integrated Circuit, NAND Gate, Type SN74H00N | IC-0018 |
| A4 | Integrated Circuit, Differential/Cascade Amplifier, Type MC 1550G | IC-0030 |
| A5 | Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A | IC-0036 |
| C1 | Capacitor, Mica, 82 PF ±5%; 500 Vdcw | C-0124 |
| C2 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C3 | Capacitor, Ceramic, Trimmer, 2.5-11 PF; 350 Vdcw | C-2303 |
| C4 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C5 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C6 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C7 | Capacitor, Mica, 82 PF ±5%; 500 Vdcw | C-0124 |
| C8 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C9 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C10 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C11 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C12 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C13 | Capacitor, Mica, 10 PF ±5%; 500 Vdcw | C-0104 |
| C14 | Capacitor, Mica, 120 PF ±5%; 500 Vdcw | C-0128 |
| C15 | Capacitor, Mica, 24 PF ±5%; 500 Vdcw | C-0110 |
| C16 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C17 | Capacitor, Mica, 120 PF ±5%; 500 Vdcw | C-0128 |
| C18 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C19 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C20 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw | C-2262 |
| C21 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C22 | Capacitor, Mica, 120 PF ±5%; 500 Vdcw | C-0128 |
| C24 | Capacitor, Mica, 120 PF ±5%; 500 Vdcw | C-0128 |
| C26 | Capacitor, Ceramic, Trimmer, 9-35 PF | C-2346 |
| C27 | Capacitor, Ceramic, Disk, 0.005 UF +80% -20%; 100 Vdcw | C-2220 |
| C28 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C29 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C30 | Capacitor, Ceramic, Trimmer, 2.5-11 PF; 350 Vdcw | C-2303 |
| C31 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C32 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C33 | Capacitor, Variable, 0.8-10.0 UF; 250 Vdcw | C-2178 |
| C34 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C35 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C36 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C37 | Capacitor, Mica, 47 PF ±5%; 500 Vdcw | C-0117 |
| C38 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C39 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C40 | Capacitor, Ceramic, Trimmer, 2.5-11 PF; 350 Vdcw | C-2303 |
| C41 | Capacitor, Variable, 0.8-10.0 UF; 250 Vdcw | C-2178 |
| C42 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C43 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C44 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C45 | Capacitor, Ceramic, Trimmer, 2.5-11 PF; 350 Vdcw | C-2303 |
| C46 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C47 | Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C48 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C49 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C50 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C51 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C52 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C53 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C54 | Capacitor, Ceramic Monolythic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C55 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C57 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C58 | Capacitor, Mica, 390 PF ±5%; 500 Vdcw | C-0141 |
| C60 | Capacitor, Ceramic, 0.02 UF +60% -40%; 150 Vdcw | C-0066 |
| C61 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| CR1 | Diode, Voltage Variable Capacitance, Type MV-1628 | CR-0084 |
| CR2 | Diode, Voltage Variable Capacitance, Type MV-1628 | CR-0084 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |

## SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY – 724-0800 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR7 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR8 | Diode, Silicon, Type 1N4454 | CR-0705 |
| L1 | Inductor, VHF, Air Wound | 724-0821 |
| L2 | Coil, Shielded, Tunable, 4.23-5.17 UH | L-0721 |
| L3 | Coil, Shielded, Tunable, 19.8-24.2 UH | L-0729 |
| L4 | Coil, Shielded, Tunable, 19.8-24.2 UH | L-0729 |
| L5 | Coil, Shielded, Tunable, .900-1.10 UH | L-0713 |
| L6 | Coil, Rf, 100.0 UH | L-0640 |
| L7 | Coil, Rf, 100.0 UH | L-0640 |
| L8 | Coil, Rf, 15.0 UH | L-0630 |
| L9 | Coil, Rf, 15.0 UH | L-0630 |
| L10 | Inductor, VHF, Air Wound | 724-0816 |
| L11 | Inductor, VHF, Air Wound | 724-0818 |
| L12 | Inductor, VHF, Air Wound | 724-0820 |
| L13 | Coil, Rf, 1.5 UH | L-0618 |
| L14 | Inductor, VHF, Air Wound | 724-0819 |
| L15 | Coil, Shielded, Tunable, 9.00-11.0 UH | L-0725 |
| L16 | Coil, Rf, 100.0 UH | L-0640 |
| L17 | Coil, Rf, 1.5 UH | L-0618 |
| L18 | Inductor, VHF, Air Wound | 724-0817 |
| L19 | Coil, Shielded, Tunable, 9.00-11.0 UH | L-0725 |
| L20 | Coil, Rf, 100.0 UH | L-0640 |
| L22 | Coil, Rf, 22 UH | L-0632 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q3 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q4 | Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer | Q-0325 |
| Q5 | Transistor, Silicon, UHF, NPN, Type 2N5179 | Q-0390 |
| R1 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| R2 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R3 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R4 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R5 | Resistor, Carbon; 27K ±10%; 1/4W | R-0041 |
| R7 | Resistor, Carbon; 27K ±10%; 1/4W | R-0041 |
| R8 | Resistor, Carbon; 27K ±10%; 1/4W | R-0041 |
| R9 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R10 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R11 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R12 | Resistor, Carbon; 15K ±10%; 1/4W | R-0038 |
| R13 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R14 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R15 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R16 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R17 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R18 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R19 | Resistor, Carbon; 1800 ohms ±10%; 1/4W | R-0027 |
| R20 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R21 | Resistor, Carbon; 1800 ohms ±10%; 1/4W | R-0027 |
| R22 | Resistor, Carbon; 1800 ohms ±10%; 1/4W | R-0027 |
| R23 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R24 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R25 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R26 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R27 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R28 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R29 | Resistor, Carbon 2200 ohms ±10%; 1/4W | R-0028 |
| R30 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R31 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R32 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R33 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R34 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R35 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R36 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R37 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R38 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R39 | Resistor, Carbon; 27 ohms ±10%; 1/4W | R-0005 |
| R40 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R44 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R45 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| Y1 | Crystal, VCO, 19.5625 MHz ±50 ppm | 724-0805 |
| — | Ejector, P.C. Board, with jacks | MP-4340 |
| — | Socket, 14 pin, Dual In-line | X-0107 |



B. Component Locations with Adjacent Side Foil

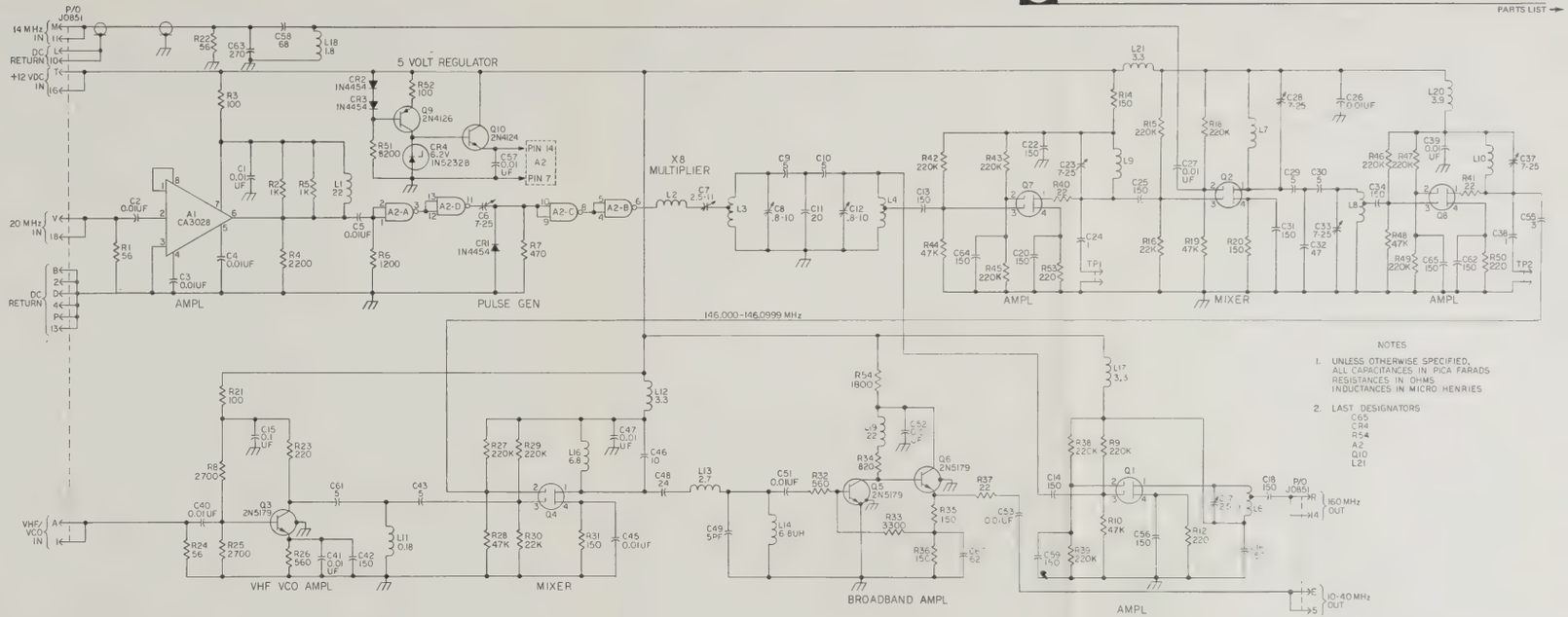


A. Component Locations with Opposite Side Foil

DC VOLTAGES*

| Stage | E | B | C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q8 | 4.50 V | 5.10 V | 9.30 V | | | | | | | | | | | |
| Q5 | 0.00 V | 0.78 V | 1.40 V | | | | | | | | | | | |
| Q6 | 1.75 V | 1.40 V | 5.00 V | | | | | | | | | | | |
| Q9 | 11.7 V | 11.0 V | 5.50 V | | | | | | | | | | | |
| Q10 | 4.90 V | 5.50 V | 12.0 V | | | | | | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | | | | | | | | | | |
| Q1 | 12.0 V | 6.00 V | 2.10 V | 2.25 V | | | | | | | | | | |
| Q2 | 12.0 V | 2.15 V | 1.20 V | 1.00 V | | | | | | | | | | |
| Q4 | 12.0 V | 2.15 V | 1.20 V | 1.00 V | | | | | | | | | | |
| Q7 | 10.7 V | 5.60 V | 1.80 V | 2.00 V | | | | | | | | | | |
| Q3 | 12.0 V | 6.10 V | 2.10 V | 2.20 V | | | | | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | | | | | | |
| A1 | 2.90 V | 5.60 V | 0.00 V | 3.20 V | 7.50 V | 11.0 V | 11.0 V | 2.00 V | | | | | | |
| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 | Pin 11 | Pin 12 | Pin 13 | Pin 14 |
| A2 | 1.30 V | 1.30 V | 1.90 V | 2.40 V | 2.40 V | 1.10 V | 0.00 V | 2.40 V | 0.68 V | 0.68 V | 1.70 V | 1.90 V | 1.90 V | 4.80 V |

* Referenced to ground.




NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL CAPACITANCES IN PICA FARADS RESISTANCES IN OHMS INDUCTANCES IN MICRO HENRIES
2. LAST DESIGNATORS
   C65
   C84
   R54
   A2
   Q10
   L21

Figure 8.8 – Translator Assembly Circuit Diagram

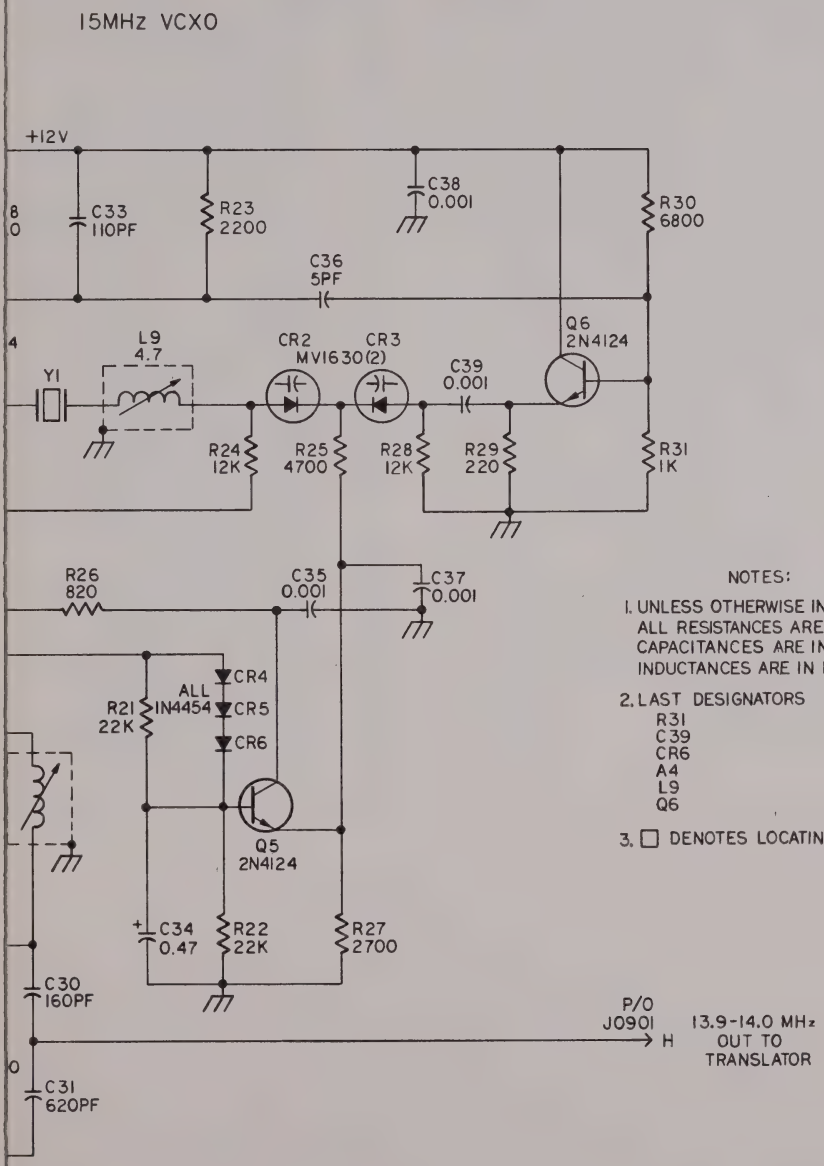



Figure 8.9 – 14 MHz Up-Mixer and VFO Assembly Circuit Diagram

## TRANSLATOR ASSEMBLY – 724-0850

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, IF Amplifier, Type CA3028A | IC-0036 |
| A2 | Integrated Circuit, NAND Gate, Type SN74H00N | IC-0018 |
| C1 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C2 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C3 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C5 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C6 | Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw | C-2304 |
| C7 | Capacitor, Variable, Ceramic, 2.5-11 PF; 350 Vdcw | C-2303 |
| C8 | Capacitor, Variable, 0.8-10.0 PF; 250 Vdcw | C-2178 |
| C9 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C10 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C11 | Capacitor, Mica, 20 PF ±5%; 500 Vdcw | C-0108 |
| C12 | Capacitor, Variable, 0.8-10.0 PF; 250 Vdcw | C-2178 |
| C13 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C14 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C15 | Capacitor, Ceramic Monolythic, 0.01 UF +80% -20%; 25 Vdcw | C-5066 |
| C16 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C17 | Capacitor, Variable, Ceramic, 2.5-11 PF; 350 Vdcw | C-2303 |
| C18 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C20 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C22 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C23 | Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw | C-2304 |
| C24 | Capacitor, Mica, 1 PF ±5%; 500 Vdcw | C-0100 |
| C25 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C26 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C27 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C28 | Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw | C-2304 |
| C29 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C30 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C31 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C32 | Capacitor, Mica, 47 PF ±5%; 500 Vdcw | C-0117 |
| C33 | Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw | C-2304 |
| C34 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C37 | Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw | C-2304 |
| C38 | Capacitor, Mica, 1 PF ±5%; 500 Vdcw | C-0100 |
| C39 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C40 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C41 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C42 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C43 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C45 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C46 | Capacitor, Mica, 10 PF ±5%; 500 Vdcw | C-0104 |
| C47 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C48 | Capacitor, Mica, 24 PF ±5%; 500 Vdcw | C-0110 |
| C49 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C51 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C52 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C53 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C55 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C56 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C57 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C58 | Capacitor, Mica, 68 PF ±5%; 500 Vdcw | C-0122 |
| C59 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C60 | Capacitor, Mica, 62 PF ±5%; 500 Vdcw | C-0121 |
| C61 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C62 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C63 | Capacitor, Mica, 270 PF ±5%; 500 Vdcw | C-0137 |
| C64 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| C65 | Capacitor, Ceramic, Disk, 150 PF ±20%; 250 Vdcw | C-2263 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Zener, 5.6 V ±10%; Type 1N5232B | CR-0262 |
| L1 | Coil, Rf, 22 UH | L-0632 |
| L2 | Coil, Inductor, VHF, Air Wound | 724-0860 |
| L3 | Coil, Inductor, VHF, Air Wound | 724-0861 |
| L4 | Coil, Inductor, VHF, Air Wound | 724-0862 |
| L6 | Coil, Inductor, VHF, Air Wound | 724-0863 |
| L7 | Coil, Inductor, VHF, Air Wound | 724-0864 |
| L8 | Coil, Inductor, VHF, Air Wound | 724-0865 |
| L9 | Coil, Inductor, VHF, Air Wound | 724-0866 |
| L10 | Coil, Inductor, VHF, Air Wound | 724-0866 |

## TRANSLATOR ASSEMBLY – 724-0850 (Cont.)

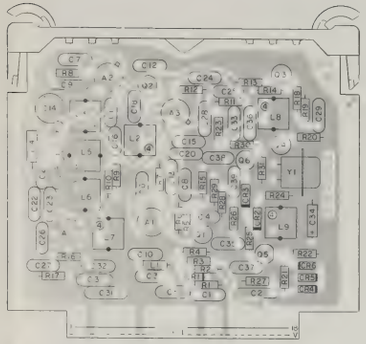
| Reference Designation | Description | RF P/N |
|---|---|---|
| L11 | Coil, Rf, 0.18 UH | L-0607 |
| L12 | Coil, Rf, 3.3 UH | L-0622 |
| L13 | Coil, Rf, 2.7 UH | L-0621 |
| L14 | Coil, Rf, 6.8 UH | L-0626 |
| L15 | Coil, Rf, 6.8 UH | L-0626 |
| L16 | Coil, Rf, 6.8 UH | L-0626 |
| L17 | Coil, Rf, 3.3 UH | L-0622 |
| L18 | Coil, Rf, 1.8 UH | L-0619 |
| L19 | Coil, Rf, 22 UH | L-0632 |
| L20 | Coil, Rf, 3.9 UH | L-0623 |
| L21 | Coil, Rf, 3.3 UH | L-0622 |
| Q1 | Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer | Q-0325 |
| Q2 | Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer | Q-0325 |
| Q3 | Transistor, Silicon, UHF, Type 2N5179 | Q-0390-1 |
| Q4 | Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer | Q-0325 |
| Q5 | Transistor, Silicon, UHF, Type 2N5179 | Q-0390-1 |
| Q6 | Transistor, Silicon, UHF, Type 2N5179 | Q-0390-1 |
| Q7 | Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer | Q-0325 |
| Q8 | Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer | Q-0325 |
| Q9 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q10 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R2 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R3 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R4 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R5 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R6 | Resistor, Carbon; 1200 ohms ±10%; 1/4W | R-0025 |
| R7 | Resistor, Carbon; 470 ohms ±10%; 1/4W | R-0020 |
| R8 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R9 | Resistor, Carbon; 220 K ±10%; 1/4W | R-0052 |
| R10 | Resistor, Carbon 47K ±10%; 1/4W | R-0044 |
| R12 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R14 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R15, | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R16 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R18 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R19 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R20 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R21 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R22 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R23 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R24 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R25 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R26 | Resistor, Carbon; 560 ohms ±10%; 1/4W | R-0021 |
| R27 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R28 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R29 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R30 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R31 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R32 | Resistor, Carbon; 560 ohms ±10%; 1/4W | R-0021 |
| R33 | Resistor, Carbon; 270 ohms ±10%; 1/4W | R-0017 |
| R34 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R35 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R36 | Resistor, Carbon; 150 ohms ±10%; 1/4W | R-0014 |
| R37 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R38 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R39 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R40 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R41 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R42 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R43 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R44 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R45 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R46 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R47 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R48 | Resistor, Carbon; 47K ±10%; 1/4W | R-0044 |
| R49 | Resistor, Carbon; 220K ±10%; 1/4W | R-0052 |
| R50 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R51 | Resistor, Carbon; 8200 ohms ±10%; 1/4W | R-0035 |
| R52 | Resistor, Carbon; 100 ohms ±10%; 1/4W | R-0012 |
| R53 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R54 | Resistor, Carbon; 1800 ohms ±10%; 1/4W | R-0027 |
| TP1 | Connector, Coaxial, Male | J-0031 |
| TP2 | Connector, Coaxial, Male | J-0031 |
| – | Socket, 14 pin, Dual In-line | X-0107 |
| – | Ejector, P.C. Board | MP-4341 |

DC VOLTAGES*

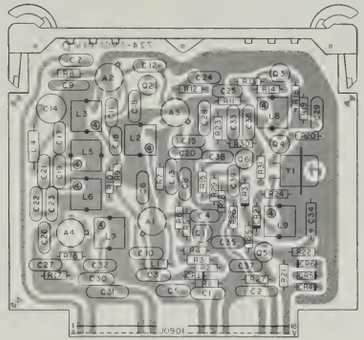
| Stage | E | B | C | VFO |
|---|---|---|---|---|
| Q1 | 0.00 V | 0.67 V | 0.00 V | Off |
| Q1 | 0.00 V | 0.00 V | 10.1 V | On |
| Q2 | 12.0 V | 11.5 V | 12.0 V | Off |
| Q2 | 12.0 V | 12.0 V | 2.40 V | On |
| Q3 | 11.0 V | 11.1 V | 0.00 V | Off |
| Q3 | 10.1 V | 9.50 V | 10.1 V | On |
| Q4 | 0.00 V | 0.00 V | 11.0 V | Off |
| Q4 | 0.00 V | 1.25 V | 10.2 V | On |
| Q5 | 0.56 V- | 1.10 V- | 12.0 V- | Off |
| | 2.60 V | 3.20 V | 11.4 V | |
| Q5 | 0.56 V- | 1.10 V- | 12.0 V- | On |
| | 2.60 V | 3.20 V | 11.4 V | |
| Q6 | 0.75 V | 1.40 V | 11.0 V | Off |
| Q6 | 0.75 V | 1.25 V | 10.1 V | On |

| | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 | Pin 10 | VFO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0.76 V | 0.00 V | 0.00 V | 0.76 V | 0.00 V | 12.0 V | 0.00 V | 5.50 V | 12.0 V | 4.75 V | Off |
| A1 | 0.76 V | 0.00 V | 0.00 V | 0.76 V | 10.1 V | 12.0 V | 0.00 V | 6.80 V | 12.0 V | 7.20 V | On |
| A2 | 0.72 V | 0.00 V | 0.00 V | 0.72 V | 0.00 V | 10.1 V | 0.00 V | 5.00 V | 10.0 V | 3.90 V | Off |
| A2 | 0.72 V | 0.00 V | 0.00 V | 0.72 V | 0.00 V | 10.1 V | 0.00 V | 5.00 V | 10.0 V | 4.30 V | On |
| A3 | 0.75 V | 0.00 V | 0.00 V | 0.75 V | 12.0 V | 12.0 V | 0.00 V | 6.50 V | 12.0 V | 7.20 V | Off |
| A3 | 0.75 V | 0.00 V | 0.00 V | 0.75 V | 2.40 V | 12.0 V | 0.00 V | 6.10 V | 12.0 V | 5.60 V | On |
| A4 | 0.00 V | 2.80 V | 0.00 V | 2.10 V | 5.70 V | 8.30 V | 8.30 V | 0.00 V | | | Off |
| A4 | 0.00 V | 2.80 V | 0.00 V | 2.10 V | 5.70 V | 8.30 V | 8.30 V | 0.00 V | | | On |

* Referenced to ground.



B. Component Locations with Adjacent Side Foil



A. Component Locations with Opposite Side Foil

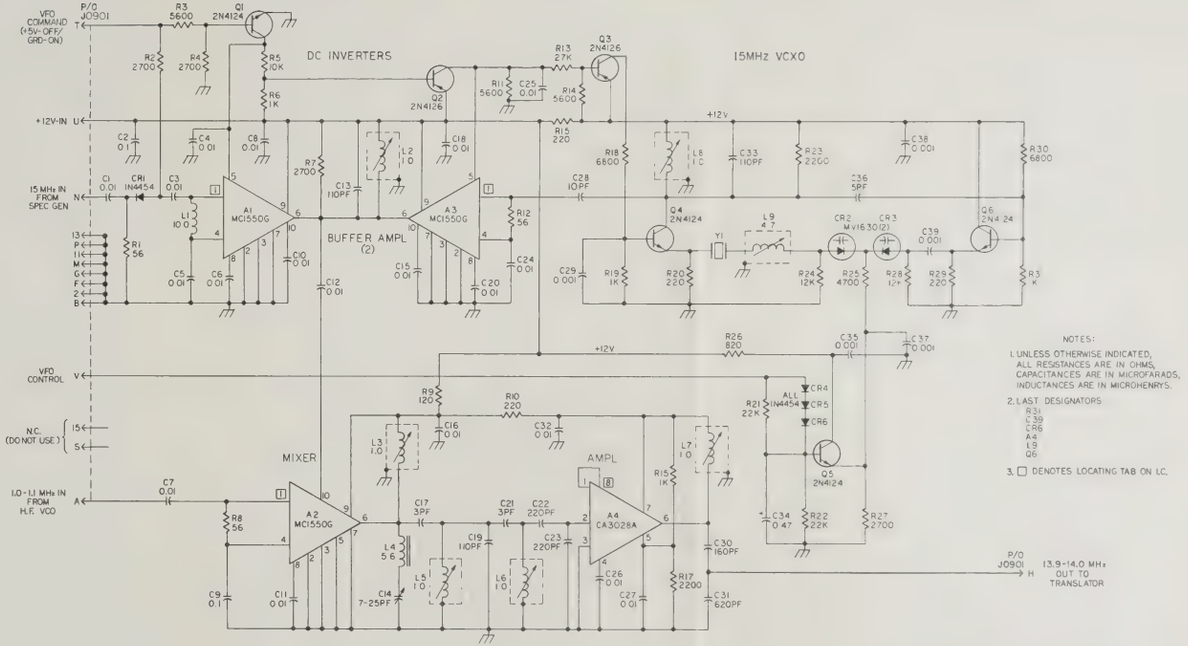



Figure 8.9 – 14 MHz Up-Mixer and VFO Assembly Circuit Diagram

## 14 MHz MIXER AND VFO ASSEMBLY – 724-0900

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A2 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A3 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A4 | Integrated Circuit, Differential/Cascode Amplifier, Type CA3028A | IC-0036 |
| C1 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C2 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C3 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C5 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C6 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C7 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C8 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C9 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C10 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C11 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C12 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C13 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C14 | Capacitor, Ceramic, Trimmer, 7-25 PF; 350 Vdcw | C-2304 |
| C15 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C16 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C17 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C18 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C19 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C20 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C21 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C22 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C23 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C24 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C25 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C26 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C27 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C28 | Capacitor, Mica, 10 PF ±5%; 500 Vdcw | C-0104 |
| C29 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C30 | Capacitor, Mica, 160 PF ±5%; 500 Vdcw | C-0131 |
| C31 | Capacitor, Mica, 620 PF ±5%; 500 Vdcw | C-0147 |
| C32 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C33 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C34 | Capacitor, Tantalum, Polar, 0.47 UF ±10%; 25 Vdcw | C-6284 |
| C35 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C36 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C37 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C38 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C39 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Varactor, Type MV1630 | CR-0085 |
| CR3 | Diode, Varactor, Type MV1630 | CR-0085 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |

## 14 MHz MIXER AND VFO ASSEMBLY 724-0900 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| L1 | Coil, Rf, Molded, 10 UH | L-0628 |
| L2 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L3 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L4 | Coil, Rf, 5.6 UH | L-0080 |
| L5 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L6 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L7 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L8 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L9 | Coil, Rf, Shielded, Tunable, 4.23-5.17 UH | L-0721 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q3 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q4 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q5 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q6 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R2 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R3 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R4 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R5 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R6 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R7 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0028 |
| R8 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R9 | Resistor, Carbon; 120 ohms ±10%; 1/4W | R-0013 |
| R10 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R11 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R12 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R13 | Resistor, Carbon; 27K ±10%; 1/4W | R-0041 |
| R14 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R15 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R16 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R17 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R18 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R19 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R20 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R21 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R22 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R23 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R24 | Resistor, Carbon; 12K ±10%; 1/4W | R-0037 |
| R25 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R26 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R27 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R28 | Resistor, Carbon; 12K ±10%; 1/4W | R-0037 |
| R29 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R30 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R31 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| Y1 | Crystal, 14.995 MHz | 724-0855 |
| — | Ejector, P.C. Board | MP-4341 |

## 14 MHz MIXER AND VFO ASSEMBLY – 724-0900

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A2 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A3 | Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G | IC-0030 |
| A4 | Integrated Circuit, Differential/Cascode Amplifier, Type CA3028A | IC-0036 |
| C1 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C2 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C3 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C4 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C5 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C6 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C7 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C8 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C9 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C10 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C11 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C12 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C13 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C14 | Capacitor, Ceramic, Trimmer, 7-25 PF; 350 Vdcw | C-2304 |
| C15 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C16 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C17 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C18 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C19 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C20 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C21 | Capacitor, Mica, 3 PF ±5%; 500 Vdcw | C-0102 |
| C22 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C23 | Capacitor, Mica, 220 PF ±5%; 500 Vdcw | C-0134 |
| C24 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C25 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C26 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C27 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C28 | Capacitor, Mica, 10 PF ±5%; 500 Vdcw | C-0104 |
| C29 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C30 | Capacitor, Mica, 160 PF ±5%; 500 Vdcw | C-0131 |
| C31 | Capacitor, Mica, 620 PF ±5%; 500 Vdcw | C-0147 |
| C32 | Capacitor, Ceramic, Disk, 0.01 UF ±20%; 100 Vdcw | C-2261 |
| C33 | Capacitor, Mica, 110 PF ±5%; 500 Vdcw | C-0127 |
| C34 | Capacitor, Tantalum, Polar, 0.47 UF ±10%; 25 Vdcw | C-6284 |
| C35 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C36 | Capacitor, Mica, 5 PF ±5%; 500 Vdcw | C-0103 |
| C37 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C38 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| C39 | Capacitor, Ceramic, Disk, 0.001 UF ±20%; 100 Vdcw | C-2262 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Varactor, Type MV1630 | CR-0085 |
| CR3 | Diode, Varactor, Type MV1630 | CR-0085 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |

## 14 MHz MIXER AND VFO ASSEMBLY 724-0900 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| L1 | Coil, Rf, Molded, 10 UH | L-0628 |
| L2 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L3 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L4 | Coil, Rf, 5.6 UH | L-0080 |
| L5 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L6 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L7 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L8 | Coil, Rf, Shielded, Tunable, 0.9-1.1 UH | L-0713 |
| L9 | Coil, Rf, Shielded, Tunable, 4.23-5.17 UH | L-0721 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q3 | Transistor, Silicon, General Purpose, PNP, Type 2N4126 | Q-0386 |
| Q4 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q5 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q6 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R2 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R3 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R4 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R5 | Resistor, Carbon; 10K ±10%; 1/4W | R-0036 |
| R6 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R7 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0028 |
| R8 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R9 | Resistor, Carbon; 120 ohms ±10%; 1/4W | R-0013 |
| R10 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R11 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R12 | Resistor, Carbon; 56 ohms ±10%; 1/4W | R-0009 |
| R13 | Resistor, Carbon; 27K ±10%; 1/4W | R-0041 |
| R14 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R15 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R16 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R17 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R18 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R19 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| R20 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R21 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R22 | Resistor, Carbon; 22K ±10%; 1/4W | R-0040 |
| R23 | Resistor, Carbon; 2200 ohms ±10%; 1/4W | R-0028 |
| R24 | Resistor, Carbon; 12K ±10%; 1/4W | R-0037 |
| R25 | Resistor, Carbon; 4700 ohms ±10%; 1/4W | R-0032 |
| R25 | Resistor, Carbon; 820 ohms ±10%; 1/4W | R-0023 |
| R27 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R28 | Resistor, Carbon; 12K ±10%; 1/4W | R-0037 |
| R29 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R30 | Resistor, Carbon; 6800 ohms ±10%; 1/4W | R-0034 |
| R31 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| Y1 | Crystal, 14.995 MHz | 724-0855 |
| – | Ejector, P.C. Board | MP-4341 |

# CHAPTER 9
# POWER SUPPLY MODULE

## 9.1 GENERAL

Power Supply Module 724-1500 provides the +5 vdc, +12 vdc, and +15 vdc operating voltages for the unit from the input primary power source. Primary power can be either ac (100 to 260 Vrms, 40 to 1000 Hz) or dc (10 to 40 volts). Ac input voltages are rectified and applied in the same manner as dc primary power sources. Output voltage control over the specified input voltage range is maintained by a proportional control circuit. For higher voltage primary power sources, either ac or dc, the conduction time of the dc-to-ac inverter is reduced thereby lowering the dc output level to the specified value. Basically the Power Supply Module consists of a 5 kHz, multivibrator, a monostable multivibrator, a dc to ac inverter, an input rectifier bridge, an output rectifier bridge, two NAND gates, a +5V post-regulator, and a +12V post-regulator.

## 9.2 THEORY OF OPERATION

**NOTE**

*Refer to figures 9.1 and 9.2 during the following discussion.*

### 9.2.1 GENERAL

The dc-to-ac inverter is controlled by the two NAND gates A1-B and A1-C, one NAND gate for each half cycle of the inverter frequency. Conduction time of each half cycle of the inverter is adjusted by the 10 kHz pulses from the monostable multivibrator while the inverter frequency is maintained by the two 5 kHz clock pulses supplied by the 5 kHz multivibrator. The 5 kHz clock pulse with the 10 kHz monostable pulse at the NAND gates alternately switch on each half of the dc-to-ac inverter, thereby providing a 5 kHz ac voltage on the secondary winding of T2. The ac voltage is in turn rectified, filtered, and regulated to +5 vdc (regulated), +12 vdc (regulated), and +15 vdc.

The width of the 10 kHz pulse is controlled in turn by the dc feedback loop which monitors the output level of the power supply at the primary of T2. When operating from low level power sources, either ac or dc, the pulse width of the monostable is increased. This increases the on time of the dc-to-ac inverter, thereby raising the average output level up to the pre-set value. For high level input voltages, the conduction time of the dc-to-ac inverter is reduced to maintain the same pre-set output level.

### 9.2.2 INPUT RECTIFIER

Input ac primary power is applied to step down transformer T1, rectified by diodes CR2 and CR3, and filtered by capacitor C2 and the inductor winding of T1. When operating from dc primary power, the input dc voltage is applied directly to C2. The input voltage at C2, proportional to the input voltage level (either ac or dc), is applied as the input to the 724-1520 assembly. Transistor Q1 and Zener diode CR4 maintain a regulated supply buss at 5 volts below the positive voltage at C2 for the two multivibrators and NAND gate circuitry.

### 9.2.3 5 KHz MULTIVIBRATOR

The 5 kHz multivibrator, consisting of transistors Q2 and Q3, provide the basic timing clock pulses for the power supply. The output pulses from both Q2 and Q3 collectors (180 degrees out of phase) are applied to the monostable as trigger pulses and as inputs to NAND gates A1-C and A1-B, respectively. Variable resistor R4 is adjusted for symmetry between the two output pulses.

### 9.2.4 TRIGGER NETWORKS

The pulse at the collector of Q2 is differentiated by C6 and R7 and is applied through diode CR5 to the collector of Q4 as one trigger pulse. Diode CR5 passes only the negative portion of the differentiated pulse. In a similar manner the pulse at the collector of Q3, which is 180 degrees out of phase from the pulse at Q2, is differentiated by C7 and R9 and applied through diode CR6 to the collector of Q4. This signal is also a negative trigger pulse, therefore, the monostable is triggered twice during each cycle of the 5 kHz multivibrator, thereby operating at 10 kHz.

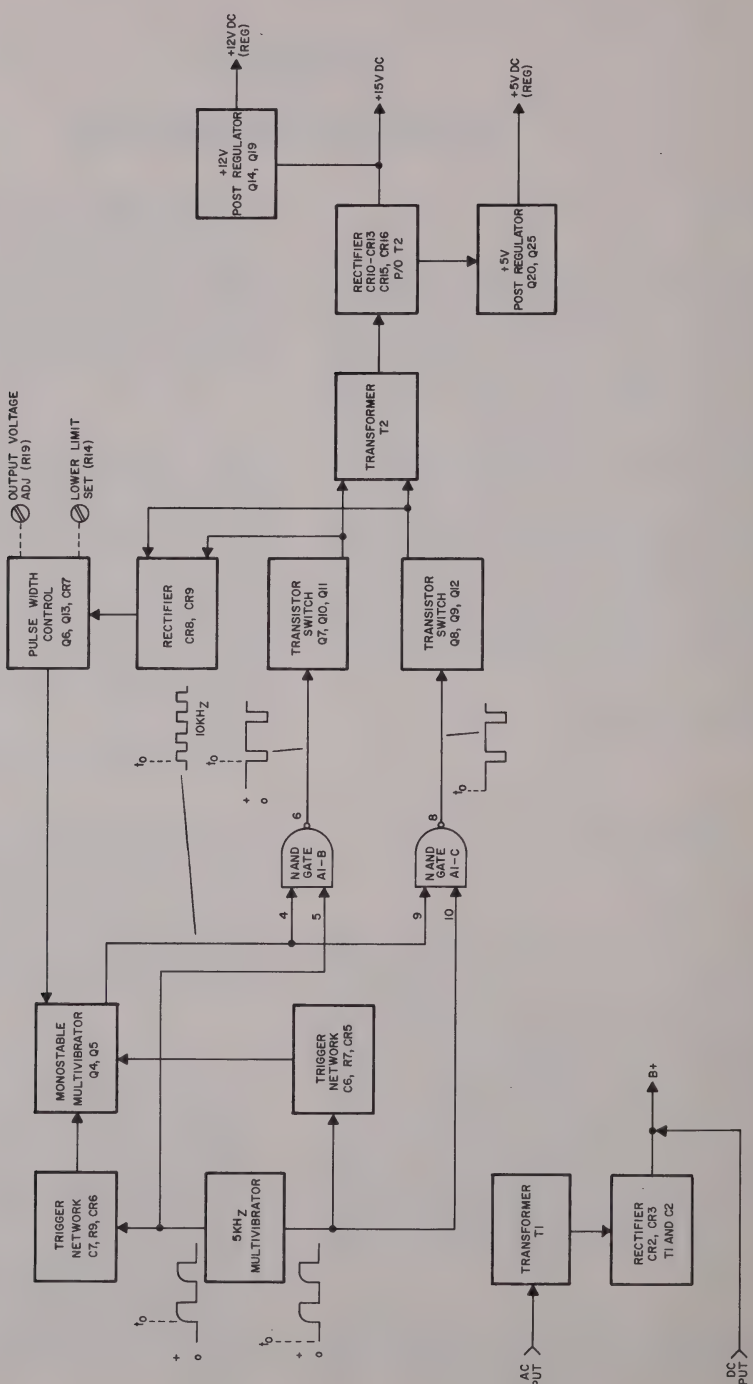



Figure 9.1 – Power Supply Block Diagram

### 9.2.5 MONOSTABLE MULTIVIBRATOR

Transistors Q4 and Q5 form the monostable multivibrator. Pulse width control is provided by transistor Q13 which is in turn controlled by the dc feedback signal. The output of the monostable is coupled from the collector of Q5 to one of the input leads on NAND gates A1-B and A1-C.

Monostable transistors Q4 and Q5 are biased with Q5 on and Q4 off. When a negative pulse is applied to the collector of Q4, transistor Q5 is switched off and Q4 is biased on. The base bias at Q5 determines the duration that Q4 will conduct and is adjusted by variable resistor R14, lower limit set. With the input voltage across C2 below the minimum value (10 vdc or rectified ac equivalent) the pulse width of the monostable is adjusted by R14 to the maximum width that will allow a 10 kHz trigger rate.

For higher input voltage levels, transistor Q6 shunts R14 and increases the base current at Q5 to shorten the pulse width, refer to paragraph 9.2.8.

### 9.2.6 NAND GATES A1-B AND A1-C

The operation of the two NAND gates are identical, therefore only the operation of NAND gate A1-B will be explained below.

With reference to pin 7 (common) of A1, the output of the NAND gate is low (less than 0.5 vdc) only if the two inputs leads, pins 4 and 5, are both high (greater than 1.5 vdc). If either or both of the two inputs goes low, then the output is high.

One input to A1-B is the 5 kHz clock pulse from the collector of Q3. The other input is the 10 kHz output of the monostable. When both Q3 and Q5 are biased off, the output of A1-B, pin 6, is low. This low signal biases on transistor switch Q7. In a similar manner, when transistors Q2 and Q5 are biased off, NAND gate A1-C will be low, turning on transistor switch Q8.

### 9.2.7 TRANSISTOR SWITCHES Q7 THROUGH Q12

Transistor Q8 is switched on by the negative output pulse from NAND gate A1-C. When conducting, Q8 forward biases transistors Q10 and Q12, a Darlington pair, causing current to flow from the center tap through one half of T2 primary winding. In the same manner, when Q8 is biased off, Q7 is switched on by the negative pulse from NAND gate A1-B. This causes current to flow through the other half of T2 primary winding. The current flowing alternately from the center tap through each half of the primary winding is induced into the secondary as a 5 kHz ac voltage.

### 9.2.8 RECTIFIERS CR8/CR9

Diodes CR8/CR9, resistors R27/R28, and capacitor C10 rectify and filter the ac output pulses at transistors Q11 and Q12 to supply a negative dc voltage to the base of Q6. The negative voltage across C10 is proportional to the average value of the full wave rectified transformer primary voltage and is used to control the pulse width of the monostable.

For high voltage primary power sources the voltage at Q6 base is increased in a negative value until it is sufficient to bias Q6 on. When conducting, Q6 drives the base of Q3 to increase the current at the base of Q5. This shortens the output pulse applied to NAND gates A1-B and A1-C to reduce the duty cycle of the dc-to-ac inverter and lower the output voltage. Variable resistor R19 controls the voltage level at Q6 and is adjusted to provide 15 Vdc output at pin 14 of J1501 with an input ac primary power source of 150 Vrms.

When the average value at C10 increases, Q6 is turned on harder to further reduce the pulse width and lower the average value at C10. This will continue until the voltage at the base of Q6 is 0.6 volts more negative than the voltage across Zener diode CR7. At this level, the pulse width of the monostable will stabilize and further correction by the dc feedback loop of the output level ceases. Variable resistor R19, output level adjust, and R20 with R27 provide a voltage divider network for output level control.

### 9.2.9 OUTPUT RECTIFIER AND POST REGULATORS

Two fullwave rectifier circuits supply the +15 Vdc and +6.5 Vdc to two filter circuits. Fuses F1 and F2 provide circuit protection against shorts or overloads in the system. The +15 Vdc is applied to the output at J1501 pin 14 and to a 12 volt post regulator. The +6.5 Vdc is applied directly to a 5 volt post regulator. These regulators in turn supply +12 Vdc and +5 Vdc to J1501 pin 6 and J1501 pin 12 respectively. The +12 Vdc post regulator output is also used as a bias voltage in the +5 Vdc regulator.

Output voltage from the +12 V post regulator is controlled by the voltage drop across Q14 and is a function of the current drawn by this transistor and is controlled by Q15. Transistor Q15 is controlled in turn by a differential amplifier with Darlington pair inputs. Transistors Q16, Q17, Q18, and Q19 compose the differential amplifier. Output voltage error is sensed by comparing the voltage level on the base of Q19 with the Zener diode voltage level on the base of Q16. Any difference detected in these voltage levels unbalances the differential amplifier and adjusts the current drawn by Q14 until the output voltage is correct. The +5 vdc post regulator works in the same manner.

## 9.3 TEST AND ALIGNMENT PROCEDURES

**WARNING**

*Dangerous voltages are present on the terminals of the Power Supply Module.*

### 9.3.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Oscilloscope – Tektronix, Model 531
b. Ac vtvm – Ballentine, Model 314
c. Dc vom – Simpson, Model 260
d. Dc power supply – HP, Model 6291A
e. Autotransformer
f. Fabricated test circuit, refer to figure 9.3.

### 9.3.2 PRELIMINARY

a. Refer to chapter 5 and remove the module from the unit. Remove the top cover from the module.

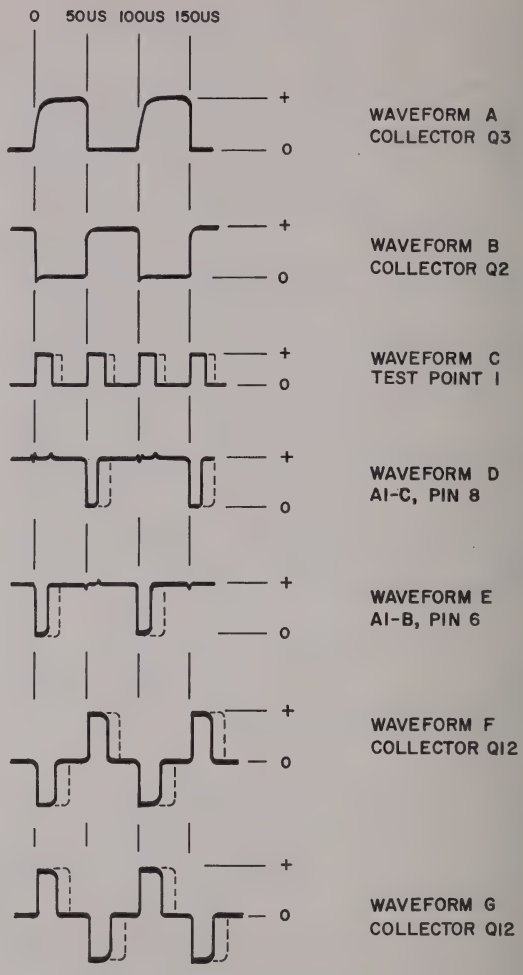
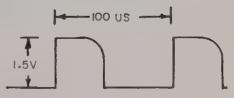



Figure 9.2 – Power Supply Waveforms

b. Refer to figure 9.3 and connect the test circuit and all test equipment except the dc power supply.

## 9.3.3 PROCEDURES

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | Connect positive probe of dc vom to J1501, pin 14; ground probe to pin 9. | Adjust input ac voltage, J1501 pins 1 and 2, from 100 to 260 Vrms. | +15.5 ±1.5 vdc. |
| 2. | Connect positive probe of dc vom to J1501, pin 6; ground probe to pin 9. | Adjust input ac voltage, J1501 pins 1 and 2, from 100 to 260 Vrms. | +12.0 ±0.2 vdc. |
| 3. | Connect positive probe of dc vom to J1501, pin 12; ground probe to pin 9. | Adjust input ac voltage, J1501 pins 1 and 2, from 100 to 260 Vrms. | +5.0 ±0.1 vdc. |
| 4. | Disconnect dc vom. | Set input ac voltage at 150 Vrms. | |
| 5. | Connect ac vtvm probe to J1501, pin 6, ground lead to pin 9. | Same as step 4. | Less than 1.5 mVrms ripple. |
| 6. | Connect ac vtvm probe to J1501, pin 12; ground lead to pin 9. | Same as step 4. | Less than 500 uVrms ripple. |
| 7. | Disconnect ac vtvm and autotransformer. Connect dc power supply; positive terminal to J1501 pin 10, negative terminal to pin 4. | Repeat steps 1, 2, and 3 by varying dc input voltage from 10 to 40 vdc.<br>**NOTE**<br>*If the results of steps 1 through 7 are not acceptable perform the procedures outlined in steps 8 through 15 and then recheck steps 1 through 7. If the results are still not acceptable refer to paragraph 4, troubleshooting.* | Same as steps 1, 2, and 3. |
| 8. | Disconnect dc power supply and reconnect ac autotransformer. | Set input ac voltage, J1501 pin 1 and 2, at 60 Vrms. | |
| 9. | Connect oscilloscope probe to TP1, ground clip to TP2. | Adjust oscilloscope for displayed waveform. If waveform is incorrect proceed with step 10. |  |
| 10. | Same as step 9. | Adjust R4, R14, and R19, figure 9.5, to their mid-range positions. | |
| 11. | Same as step 9. | Adjust R4 for a symmetrical waveform and R14 for a duty ratio of 80% on. | |
| 12. | | Adjust input ac voltage to 150 Vrms. | |
| 13. | Connect positive probe of dc vom to either end of fuse F2, figure 9.6; ground probe to chassis. | Adjust R19. | +6.5 vdc |
| 14. | Connect positive probe of dc vom to J1501, pin 6; ground probe to pin 9. | Adjust R35 on post-regulator assembly, figure 9.6. | +12.0 ±.2 vdc. |
| 15. | Connect positive probe of dc vom to J1501, pin 12; ground probe to pin 9. | Adjust R41 on post-regulator assembly, figure 9.6. | +5.0 ±0.1 vdc. |
| 16. | Disconnect test equipment and reinstall module in unit. | | |

## 9.4 FAULT ANALYSIS

Fault analysis procedures for Power Supply Module 724-1500 are presented below in tabular form. Refer to figure 9.2 for ac waveforms, and to figure 9.6 for dc and ac voltages charts, printed circuit component locations, and the schematic diagram.

Table 9.1 — Fault Analysis

| SYMPTOM | POSSIBLE TROUBLE | CHECKS AND CORRECTIVE MEASURES |
|---|---|---|
| No output with either ac or dc input voltages. | Faulty circuitry. | Refer to figures 9.2 and 9.6. Make voltage waveform and dc voltage measurements. Replace faulty components. |
| No output with dc input voltage. Ac operation normal. | Diode CR6 open on main frame of unit. | Check diode and replace if faulty, refer to chapter 7. |
| No output with ac input voltage. Dc operation normal. | Transformer T1 or associated circuitry defective. | Check transformer windings and diodes CR2 and CR3. Replace defective components. |
| All output voltages out of spec with input voltage greater than 90 Vrms or 10 vdc. | R14 or R19 improperly adjusted. | Refer to paragraph 9.3 and perform alignment procedures. |
| +12 V and +5 V outputs out of spec. +15 V output proper. | a. R35 improperly adjusted. | Refer to paragraph 9.3 and perform alignment procedures. |
| | b. +12 V post-regulator circuit defective. | Refer to figure 9.6. Make voltage measurements. Replace defective component. |
| +5 V output out of spec. +12 V and +15 V outputs proper | R41 improperly adjusted. | Refer to paragraph 9.3 and perform alignment procedures. |
| | +5 V post-regulator circuit defective. | Refer to figure 9.6. Make voltage measurements. Replace defective component. |

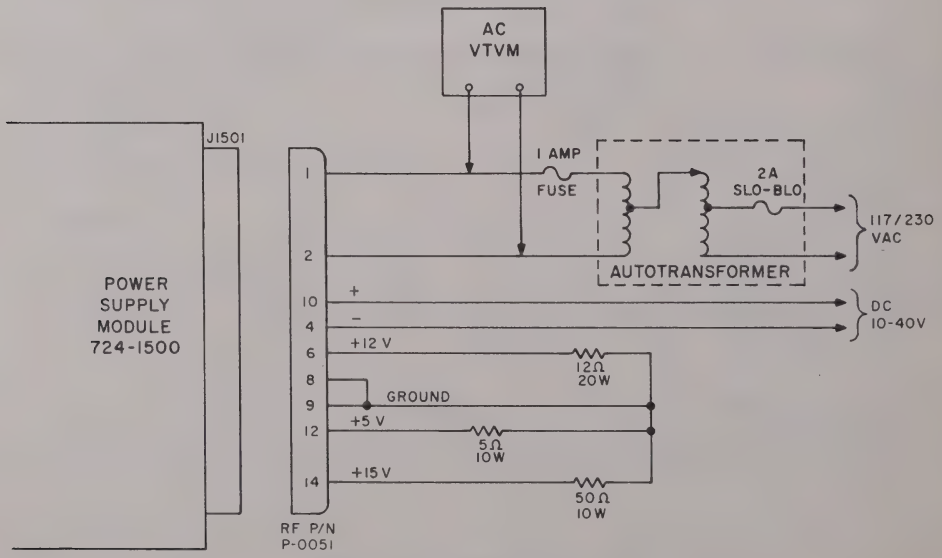



Figure 9.3 — Fabricated Test Circuit

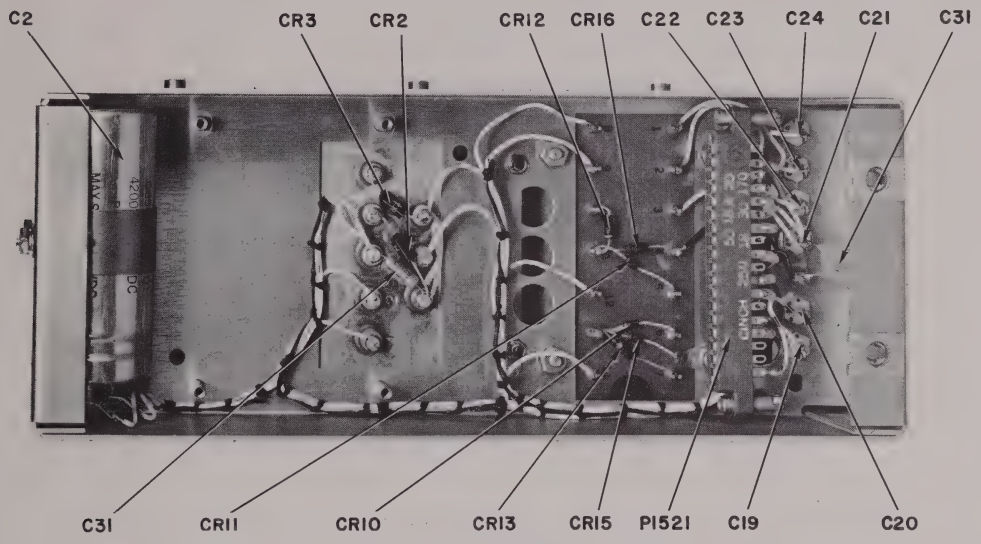



Figure 9.4 — Component Locations, Top View

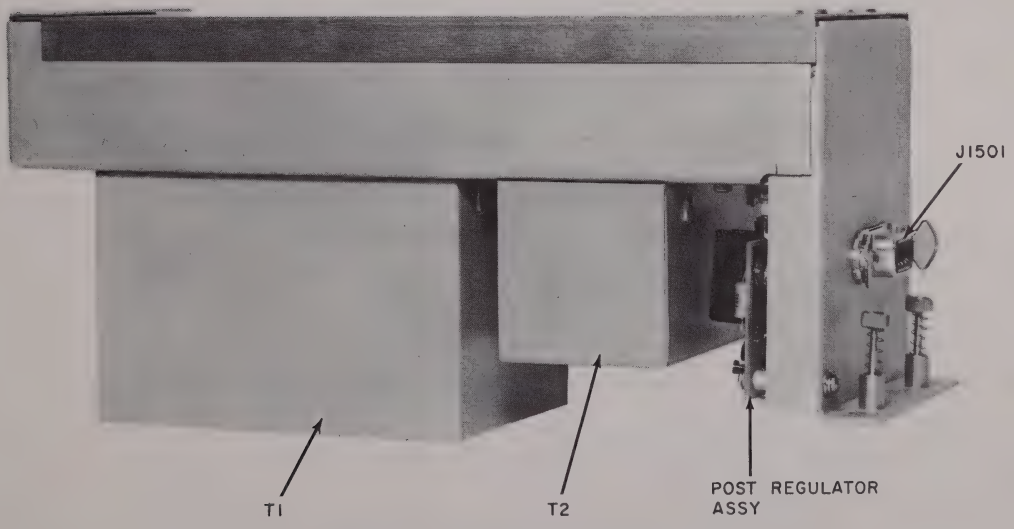



Figure 9.5 — Component Locations, Side View

## 9.5 CIRCUIT DIAGRAM AND PARTS LIST

**NOTE**

*The parts list of the assemblies are located on the back of the circuit diagram.*

# NOTES

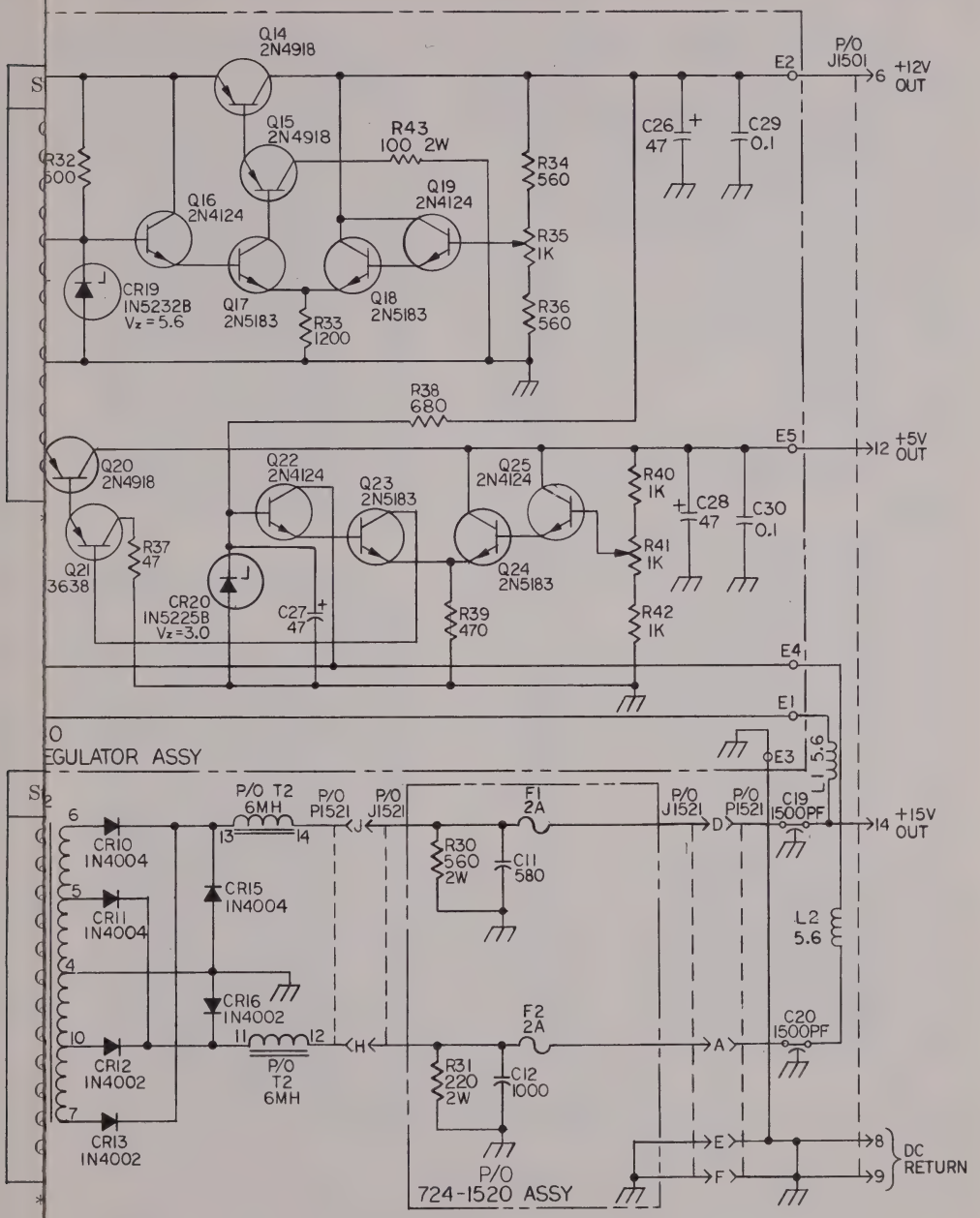



Figure 9.6 — Power Supply Module Circuit Diagram

AC VOLTAGES*

| Stage | E | B | C |
|---|---|---|---|
| Q1 | 0.80 | 0.78 | 2.8 |
| Q2 | 0.80 | 1.6 | 1.9 |
| Q3 | 0.80 | 0.96 | 2.0 |
| Q4 | 0.78 | 9.9 | 1.8 |
| Q5 | 1.8 | 0.31 | 0.77 |
| Q6 | 0.74 | 0.77 | 0.37 |
| Q7 | 1.4 | 1.1 | 5.9 |
| Q8 | 0.82 | 0.89 | 5.9 |
| Q9 | 3.3 | 3.7 | 23.0 |
| Q10 | 3.2 | 3.7 | 19.0 |
| Q11 | 2.8 | 3.3 | 25.0 |
| Q12 | 2.8 | 3.2 | 21.0 |
| Q13 | 0.51 | 0.37 | 0.81 |

*Referenced to TP2

DC VOLTAGES*

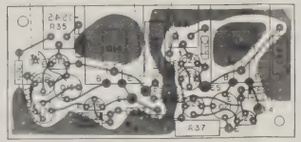
| Stage | E | B | C |
|---|---|---|---|
| Q1 | 0 | -0.64 | -6.8 |
| Q2 | 0 | -0.42 | 2.45 |
| Q3 | 0 | -0.42 | 2.45 |
| Q4 | 0 | 0.28 | 2.7 |
| Q5 | 0 | 0.12 | 0.76 |
| Q6 | 0.10 | 5.0 | 5.0 |
| Q7 | 4.0 | 3.4 | -5.4 |
| Q8 | 4.0 | 3.4 | -5.4 |
| Q9 | 4.9 | -6.6 | -6.6 |
| Q10 | 4.9 | -6.6 | -6.6 |
| Q11 | -6.8 | 4.9 | 4.8 |
| Q12 | -6.8 | 4.9 | 4.8 |
| Q13 | 2.4 | 2.0 | -0.22 |

*Referenced to TP2, Maximum Load

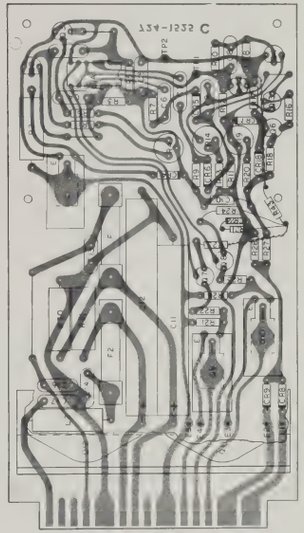
POST REGULATOR
DC VOLTAGES*

| Stage | E | B | C |
|---|---|---|---|
| Q14 | 12.5 | 11.5 | 11.5 |
| Q15 | 11.5 | 11.0 | 11.5 |
| Q16 | 5.0 | 5.5 | 12.5 |
| Q17 | 4.5 | 5.0 | 11.0 |
| Q18 | 4.5 | 5.5 | 11.5 |
| Q19 | 5.1 | 5.6 | 11.5 |
| Q20 | 5.1 | 4.5 | 4.4 |
| Q21 | 4.5 | 2.9 | 2.7 |
| Q22 | 2.2 | 2.6 | 3.4 |
| Q24 | 1.5 | 2.2 | 3.3 |
| Q24 | 1.7 | 2.3 | 4.4 |
| Q25 | 2.3 | 2.8 | 4.4 |

*Referenced to ground.



Post Regulator Assembly




724-1520 Assembly

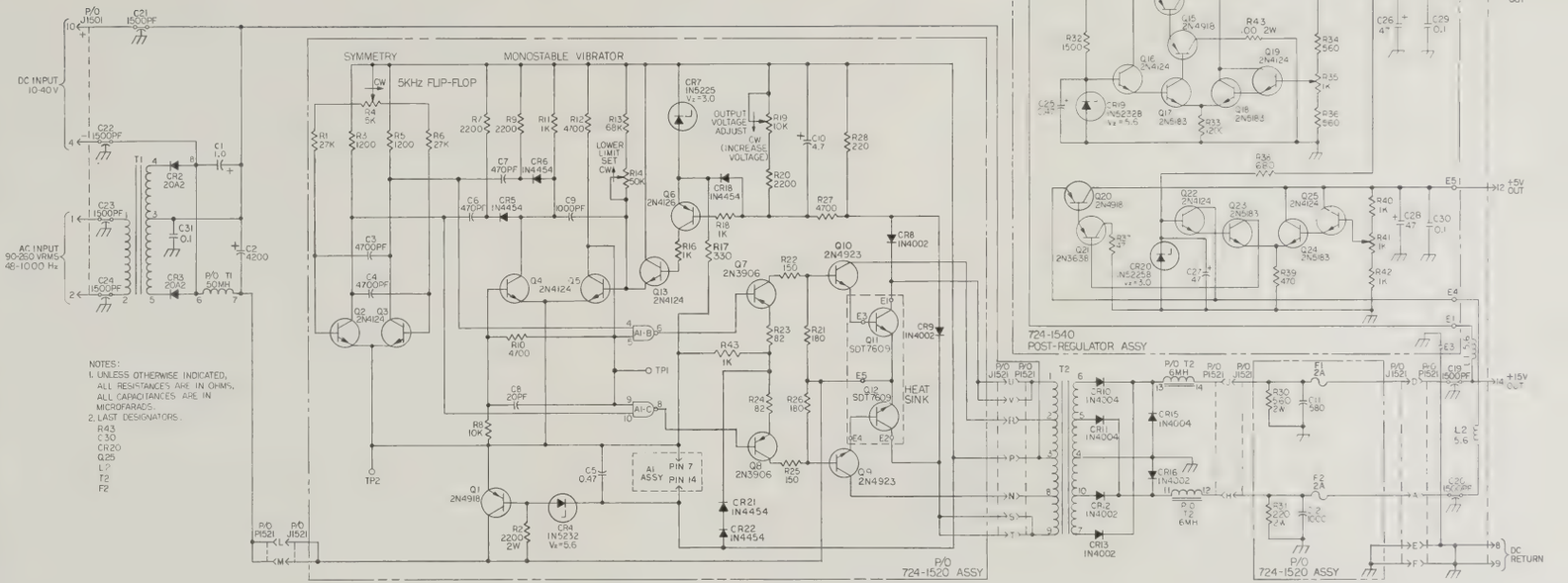



Figure 9.6 — Power Supply Module Circuit Diagram

## POWER SUPPLY MODULE – 724-1500

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Tantalum, Electrolyte, 1.0 UF ±20%; 100 Vdcw | C-5880 |
| C2 | Capacitor, Aluminum, Electrolyte, 4200 UF; 40 Vdcw | C-6360 |
| C19 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C20 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C21 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C22 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C23 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C24 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C31 | Capacitor, Ceramic, 0.1 UF +80% -30%; 75 Vdcw | C-0063 |
| CR2 | Diode, Silicon, Type 20A2 | CR-0706 |
| CR3 | Diode, Silicon, Type 20A2 | CR-0706 |
| CR10 | Diode, Silicon, Type 1N4004 | CR-0725 |
| CR11 | Diode, Silicon, Type 1N4004 | CR-0725 |
| CR12 | Diode, Silicon, Type 1N4002 | CR-0071 |
| CR13 | Diode, Silicon, Type 1N4002 | CR-0071 |
| CR15 | Diode, Silicon, Type 1N4004 | CR-0725 |
| CR16 | Diode, Silicon, Type 1N4002 | CR-0071 |
| J1501 | Connector, Power | J-0051 |
| L1 | Coil, Rf, 5.6 UH | L-0331 |
| L2 | Coil, Rf, 5.6 UH | L-0331 |
| P1521 | Connector, 18 Pin | 724-0148 |
| T1 | Input Power Transformer | 724-1515 |
| T2 | Toroidal Transformer | 724-1518 |

## BOARD ASSEMBLY – 724-1520

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Quad, 2 Input Gate SN7400N | IC-0010 |
| C3 | Capacitor, Mica, 4700 PF ±5%; 500 Vdcw | C-0169 |
| C4 | Capacitor, Mica, 4700 PF ±5%; 500 Vdcw | C-0169 |
| C5 | Capacitor, Ceramic, 0.47 UF +80% -20%; 10 Vdcw | C-0058 |
| C6 | Capacitor, Mica, 470 PF ±5%; 500 Vdcw | C-0143 |
| C7 | Capacitor, Mica, 470 PF ±5%; 500 Vdcw | C-0143 |
| C8 | Capacitor, Mica, 20 PF ±5%; 500 Vdcw | C-0108 |
| C9 | Capacitor, Mica, 1000 PF ±5%; 500 Vdcw | C-0152 |
| C10 | Capacitor, Tantalum, Polar, 4.7 UF ±20%; 20 Vdcw | C-6313 |
| C11 | Capacitor, 580 UF 15 Vdcw | C-4162 |
| C12 | Capacitor, Electrolytic, Aluminum, 1000 UF; 7 Vdcw | C-6361 |
| C31 | Capacitor, Ceramic, 0.1 UF +100% -20%; 30 Vdcw | C-0063 |
| CR4 | Diode, Zener, 5.6V ±10%; Type 1N5232 | CR-0211 |
| CR5 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR7 | Diode, Zener, 3.0V ±10%; Type 1N5225 | CR-0204 |
| CR8 | Diode, Silicon , Type 1N4002 | CR-0071 |
| CR9 | Diode, Silicon, Type 1N4002 | CR-0071 |
| CR18 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR21 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR22 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| F1 | Fuse, Type 3 AG, 2 Amperes | F-0012 |
| F2 | Fuse, Type 3 AG, 2 Amperes | F-0012 |
| Q1 | Transistor, Silicon, Power, PNP, 2N4918 | Q-0337 |
| Q2 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q3 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q4 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q5 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q6 | Transistor, Silicon, PNP, Type 2N4126 | Q-0386 |
| Q7 | Transistor, Silicon, PNP, Type 2N3906 | Q-0029 |
| Q8 | Transistor, Silicon, PNP, Type 2N3906 | Q-0029 |
| Q9 | Transistor, Silicon, NPN, Type 2N4923 | Q-0336 |
| Q10 | Transistor, Silicon, NPN, Type 2N4923 | Q-0336 |
| Q11 | Transistor, Silicon, NPN, Type SDT7609 | Q-0032 |
| Q12 | Transistor, Silicon, NPN, Type SDT7609 | Q-0032 |
| Q13 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon, 27K ±10%; 1/4W | R-0041 |
| R2 | Resistor, Carbon, 2.2K ±10%; 2W | R-0328 |

## BOARD ASSEMBLY – 724-1520 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| R3 | Resistor, Carbon, 1.2K ±10%; 1/4W | R-0025 |
| R4 | Resistor, Variable, Single turn, 5K ±10%; 1/2W | R-7216 |
| R5 | Resistor, Carbon, 1.2K ±10%; 1/4W | R-0025 |
| R6 | Resistor, Carbon, 27K ±10%; 1/4W | R-0041 |
| R7 | Resistor, Carbon, 2.2K ±10%; 1/4W | R-0028 |
| R8 | Resistor, Carbon, 10K ±10%; 1/4W | R-0036 |
| R9 | Resistor, Carbon, 2.2K ±10%; 1/4W | R-0028 |
| R10 | Resistor, Carbon, 4.7K ±10%; 1/4W | R-0032 |
| R11 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R12 | Resistor, Carbon, 4.7K ±10%; 1/4W | R-0032 |
| R13 | Resistor, Carbon, 68K ±10%; 1/4W | R-0046 |
| R14 | Resistor, Variable, Single turn, 50K ±10%; 1/2W | R-7226 |
| R16 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R17 | Resistor, Carbon, 330 ohms ±10%; 1/4W | R-0018 |
| R18 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R19 | Resistor, Variable, Single Turn, 10K ±10%; 1/2W | R-7220 |
| R20 | Resistor, Carbon, 2.2K ±10%; 1/4W | R-0028 |
| R21 | Resistor, Carbon, 180 ohms ±10%; 1/4W | R-0015 |
| R22 | Resistor, Carbon, 150 ohms ±10%; 1/4W | R-0014 |
| R23 | Resistor, Carbon, 82 ohms ±10%; 1/2W | R-0111 |
| R24 | Resistor, Carbon, 82 ohms ±10%; 1/2W | R-0111 |
| R25 | Resistor, Carbon, 150 ohms ±10%; 1/4W | R-0014 |
| R26 | Resistor, Carbon, 180 ohms ±10%; 1/4W | R-0015 |
| R27 | Resistor, Carbon, 4.7K ±10%; 1/4W | R-0032 |
| R28 | Resistor, Carbon, 220 ohms ±10%; 1/4W | R-0016 |
| R30 | Resistor, Carbon, 560 ohms ±10%; 2W | R-0321 |
| R31 | Resistor, Carbon, 220 ohms ±10%; 2W | R-0316 |
| R43 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| – | Socket, 14 pin, Dual In-line | X-0107 |

## POST REGULATOR ASSEMBLY – 724-1540

| Reference Designation | Description | RF P/N |
|---|---|---|
| C25 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C26 | Capacitor, Tantalum, 47 UF ±20%; 20 Vdcw | C-2171 |
| C27 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C28 | Capacitor, Tantalum, Polar, 47 UF ±20%; 6 Vdcw | C-6357 |
| C29 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C30 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| CR19 | Diode, Zener, 5.6V ±10%, Type 1N5232B | CR-0211 |
| CR20 | Diode, Zener, 3.0V ±10%, Type 1N5225B | CR-0204 |
| Q14 | Transistor, NPN, Power, Type 2N4918 | Q-0337 |
| Q15 | Transistor, NPN, Power, Type 2N4918 | Q-0337 |
| Q16 | Transistor, Silicon, Type NPN, 2N4124 | Q-0385 |
| Q17 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q18 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q19 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q20 | Transistor, NPN, Power, Type 2N4918 | Q-0337 |
| Q21 | Transistor, NPN, Type 2N3638A | Q-0319 |
| Q22 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q23 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q24 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q25 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| R32 | Resistor, Carbon, 1.5K ±10%; 1/4W | R-0026 |
| R33 | Resistor, Carbon, 1.2K ±10%; 1/4W | R-0025 |
| R34 | Resistor, Carbon, 560 ohms ±10%; 1/4W | R-0021 |
| R35 | Resistor, Variable, Single turn, 1K ±10%; 1/2W | R-7209 |
| R36 | Resistor, Carbon, 560 ohms ±10%; 1/4W | R-0021 |
| R37 | Resistor, Carbon, 47 ohms ±10%; 1W | R-0208 |
| R38 | Resistor, Carbon, 680 ohms ±10%; 1/4W | R-0022 |
| R39 | Resistor, Carbon, 470 ohms ±10%; 1/4W | R-0020 |
| R40 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R41 | Resistor, Variable, Single turn, 1K ±10%; 1/2W | R-7209 |
| R42 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R44 | Resistor, Carbon, 100 ohms ±10%; 2W | R-0312 |

## POWER SUPPLY MODULE – 724-1500

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Tantalum, Electrolyte, 1.0 UF ±20%; 100 Vdcw | C-5880 |
| C2 | Capacitor, Aluminum, Electrolyte, 4200 UF; 40 Vdcw | C-6360 |
| C19 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C20 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C21 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C22 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C23 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C24 | Capacitor, Feed-thru, 1500 PF ±20%; 500 Vdcw | C-2651 |
| C31 | Capacitor, Ceramic, 0.1 UF +80% -30%; 75 Vdcw | C-0063 |
| CR2 | Diode, Silicon, Type 20A2 | CR-0706 |
| CR3 | Diode, Silicon, Type 20A2 | CR-0706 |
| CR10 | Diode, Silicon, Type 1N4004 | CR-0725 |
| CR11 | Diode, Silicon, Type 1N4004 | CR-0725 |
| CR12 | Diode, Silicon, Type 1N4002 | CR-0071 |
| CR13 | Diode, Silicon, Type 1N4002 | CR-0071 |
| CR15 | Diode, Silicon, Type 1N4004 | CR-0725 |
| CR16 | Diode, Silicon, Type 1N4002 | CR-0071 |
| J1501 | Connector, Power | J-0051 |
| L1 | Coil, Rf, 5.6 UH | L-0331 |
| L2 | Coil, Rf, 5.6 UH | L-0331 |
| P1521 | Connector, 18 Pin | 724-0148 |
| T1 | Input Power Transformer | 724-1515 |
| T2 | Toroidal Transformer | 724-1518 |

## BOARD ASSEMBLY – 724-1520

| Reference Designation | Description | RF P/N |
|---|---|---|
| A1 | Integrated Circuit, Quad, 2 Input Gate SN7400N | IC-0010 |
| C3 | Capacitor, Mica, 4700 PF ±5%; 500 Vdcw | C-0169 |
| C4 | Capacitor, Mica, 4700 PF ±5%; 500 Vdcw | C-0169 |
| C5 | Capacitor, Ceramic, 0.47 UF +80% -20%; 10 Vdcw | C-0058 |
| C6 | Capacitor, Mica, 470 PF ±5%; 500 Vdcw | C-0143 |
| C7 | Capacitor, Mica, 470 PF ±5%; 500 Vdcw | C-0143 |
| C8 | Capacitor, Mica, 20 PF ±5%; 500 Vdcw | C-0108 |
| C9 | Capacitor, Mica, 1000 PF ±5%; 500 Vdcw | C-0152 |
| C10 | Capacitor, Tantalum, Polar, 4.7 UF ±20%; 20 Vdcw | C-6313 |
| C11 | Capacitor, 580 UF 15 Vdcw | C-4162 |
| C12 | Capacitor, Electrolytic, Aluminum, 1000 UF; 7 Vdcw | C-6361 |
| C31 | Capacitor, Ceramic, 0.1 UF +100% -20%; 30 Vdcw | C-0063 |
| CR4 | Diode, Zener, 5.6V ±10%; Type 1N5232 | CR-0211 |
| CR5 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR7 | Diode, Zener, 3.0V ±10%; Type 1N5225 | CR-0204 |
| CR8 | Diode, Silicon , Type 1N4002 | CR-0071 |
| CR9 | Diode, Silicon, Type 1N4002 | CR-0071 |
| CR18 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR21 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| CR22 | Diode, Silicon, Signal; Type 1N4454 | CR-0705 |
| F1 | Fuse, Type 3 AG, 2 Amperes | F-0012 |
| F2 | Fuse, Type 3 AG, 2 Amperes | F-0012 |
| Q1 | Transistor, Silicon, Power, PNP, 2N4918 | Q-0337 |
| Q2 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q3 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q4 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q5 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q6 | Transistor, Silicon, PNP, Type 2N4126 | Q-0386 |
| Q7 | Transistor, Silicon, PNP, Type 2N3906 | Q-0029 |
| Q8 | Transistor, Silicon, PNP, Type 2N3906 | Q-0029 |
| Q9 | Transistor, Silicon, NPN, Type 2N4923 | Q-0336 |
| Q10 | Transistor, Silicon, NPN, Type 2N4923 | Q-0336 |
| Q11 | Transistor, Silicon, NPN, Type SDT7605 | Q-0032 |
| Q12 | Transistor, Silicon, NPN, Type SDT7609 | Q-0032 |
| Q13 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon, 27K ±10%; 1/4W | R-0041 |
| R2 | Resistor, Carbon, 2.2K ±10%; 2W | R-0328 |

## BOARD ASSEMBLY – 724-1520 (Cont.)

| Reference Designation | Description | RF P/N |
|---|---|---|
| R3 | Resistor, Carbon, 1.2K ±10%; 1/4W | R-0025 |
| R4 | Resistor, Variable, Single turn, 5K ±10%; 1/2W | R-7216 |
| R5 | Resistor, Carbon, 1.2K ±10%; 1/4W | R-0025 |
| R6 | Resistor, Carbon, 27K ±10%; 1/4W | R-0041 |
| R7 | Resistor, Carbon, 2.2K ±10%; 1/4W | R-0028 |
| R8 | Resistor, Carbon, 10K ±10%; 1/4W | R-0036 |
| R9 | Resistor, Carbon, 2.2K ±10%; 1/4W | R-0028 |
| R10 | Resistor, Carbon, 4.7K ±10%; 1/4W | R-0032 |
| R11 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R12 | Resistor, Carbon, 4.7K ±10%; 1/4W | R-0032 |
| R13 | Resistor, Carbon, 68K ±10%; 1/4W | R-0046 |
| R14 | Resistor, Variable, Single turn, 50K ±10%; 1/2W | R-7226 |
| R16 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R17 | Resistor, Carbon, 330 ohms ±10%; 1/4W | R-0018 |
| R18 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R19 | Resistor, Variable, Single Turn, 10K ±10%; 1/2W | R-7220 |
| R20 | Resistor, Carbon, 2.2K ±10%; 1/4W | R-0028 |
| R21 | Resistor, Carbon, 180 ohms ±10%; 1/4W | R-0015 |
| R22 | Resistor, Carbon, 150 ohms ±10%; 1/4W | R-0014 |
| R23 | Resistor, Carbon, 82 ohms ±10%; 1/2W | R-0111 |
| R24 | Resistor, Carbon, 82 ohms ±10%; 1/2W | R-0111 |
| R25 | Resistor, Carbon, 150 ohms ±10%; 1/4W | R-0014 |
| R26 | Resistor, Carbon, 180 ohms ±10%; 1/4W | R-0015 |
| R27 | Resistor, Carbon, 4.7K ±10%; 1/4W | R-0032 |
| R28 | Resistor, Carbon, 220 ohms ±10%; 1/4W | R-0016 |
| R30 | Resistor, Carbon, 560 ohms ±10%; 2W | R-0321 |
| R31 | Resistor, Carbon, 220 ohms ±10%; 2W | R-0316 |
| R43 | Resistor, Carbon; 1K ±10%; 1/4W | R-0024 |
| — | Socket, 14 pin, Dual In-line | X-0107 |

## POST REGULATOR ASSEMBLY – 724-1540

| Reference Designation | Description | RF P/N |
|---|---|---|
| C25 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C26 | Capacitor, Tantalum, 47 UF ±20%; 20 Vdcw | C-2171 |
| C27 | Capacitor, Tantalum, Polar, 0.47 UF ±20%; 35 Vdcw | C-6285 |
| C28 | Capacitor, Tantalum, Polar, 47 UF ±20%; 6 Vdcw | C-6357 |
| C29 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| C30 | Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw | C-5066 |
| CR19 | Diode, Zener, 5.6V ±10%, Type 1N5232B | CR-0211 |
| CR20 | Diode, Zener, 3.0V ±10%, Type 1N5225B | CR-0204 |
| Q14 | Transistor, NPN, Power, Type 2N4918 | Q-0337 |
| Q15 | Transistor, NPN, Power, Type 2N4918 | Q-0337 |
| Q16 | Transistor, Silicon, Type NPN, 2N4124 | Q-0385 |
| Q17 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q18 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q19 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q20 | Transistor, NPN, Power, Type 2N4918 | Q-0337 |
| Q21 | Transistor, NPN, Type 2N3638A | Q-0319 |
| Q22 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| Q23 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q24 | Transistor, Amplifier, NPN, Type 2N5183 | Q-0006 |
| Q25 | Transistor, Silicon, NPN, Type 2N4124 | Q-0385 |
| R32 | Resistor, Carbon, 1.5K ±10%; 1/4W | R-0026 |
| R33 | Resistor, Carbon, 1.2K ±10%; 1/4W | R-0025 |
| R34 | Resistor, Carbon, 560 ohms ±10%; 1/4W | R-0021 |
| R35 | Resistor, Variable, Single turn, 1K ±10%; 1/2W | R-7209 |
| R36 | Resistor, Carbon, 560 ohms ±10%; 1/4W | R-0021 |
| R37 | Resistor, Carbon, 47 ohms ±10%; 1W | R-0208 |
| R38 | Resistor, Carbon, 680 ohms ±10%; 1/4W | R-0022 |
| R39 | Resistor, Carbon, 470 ohms ±10%; 1/4W | R-0020 |
| R40 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R41 | Resistor, Variable, Single turn, 1K ±10%; 1/2W | R-7209 |
| R42 | Resistor, Carbon, 1K ±10%; 1/4W | R-0024 |
| R44 | Resistor, Carbon, 100 ohms ±10%; 2W | R-0312 |

# CHAPTER 10
# FREQUENCY STANDARD MODULE

## 10.1 GENERAL

Frequency Standard Module 724-1600/724-1601 provides the 5.0 MHz reference signal for Synthesizer Module 724-0500. Basically, Frequency Standard Module consists of a crystal oscillator (frequency standard), a distribution amplifier, and a mode select switch.

The normally supplied 724-1600 Frequency Standard Module, figure 10.1, is equipped with a temperature compensated crystal oscillator (TCXO) standard, RF P/N 724-0150. This module is accurate to ±1 part per $10^6$ and requires no warm-up time. The optional (special order) 724-1601 module is supplied with a high stability oven-controlled crystal oscillator standard, RF P/N 724-0151. Frequency accuracy is ±5 parts per $10^8$ after a 30 minute warm-up period. Power for the oven is supplied only from ac primary power sources thereby restricting the unit to ac operation only.

## 10.2 THEORY OF OPERATION

Mode select switch S1F1 provides for the three different operating configurations of the module. When S1F1 is set at INT ONLY, the output of the frequency standard is supplied as the 5 MHz reference signal to the Synthesizer Module connected to J1602. The INT OUT position of S1F1 connects the output of the frequency standard to the Synthesizer Module and to frequency standard input/output connector J1601. In turn, J1601 is connected by the main frame harness to rear panel connector J1. This allows for up to three additional units to operate off of one frequency standard. When set at EXT IN, an external, 5 MHz, frequency standard source is used in place of the connected standard. The external source, such as a master clock or a second unit with the mode switch set at INT OUT, is also connected to rear panel connector, J2.

The distribution amplifier is a two transistor power amplifier with an output of up to 1 Vrms. Diodes CR3 through CR5 limit the input level to 1 Vrms. The signal is then amplified by Q1 and Q2 and applied to J1602 and through the INT OUT contacts of S1F1 to J1601.

## 10.3 TEST AND ALIGNMENT

**WARNING**

*Dangerous voltages are present on various terminals in the immediate vicinity of the Frequency Standard Module.*

Figure 10.1 — Frequency Standard Module 724-1600

## 10.3.1 TEST EQUIPMENT

**NOTE**

*The following test equipment or equivalent is required to perform the following procedures.*

a. Oscilloscope – Tektronix, Model 454

b. Electronic Counter – Hewlett-Packard, Model 5245

c. Adjustment Tool – J.F.D., No. 5284

d. Coax Test Cable – RF P/N 724-0032

e. Coax T Connector

## 10.3.2 PRELIMINARY

**NOTE**

*The following tests are performed with the module installed in the unit.*

a. At front panel of unit set MODE switch at ISB.

b. At Frequency Standard Module J1602 (blue) disconnect P1602 and connect oscilloscope and counter to J1602 using the coax test cable and T connector. Set S1F1 at INT ONLY.

## 10.3.3 PROCEDURES

| STEP NO. | TEST EQUIPMENT AND TEST POINT | PROCEDURE | PERFORMANCE |
|---|---|---|---|
| 1. | Oscilloscope and counter at J1602. | Measure frequency and check displayed waveform. If frequency as displayed on counter is out of spec refer to step 2. | 5.000000 MHz ±5 Hz Refer to figure 10.2. |
| 2. | Same as step 1. | Remove access screw on frequency standard, figure 10.1 and adjust standard frequency control for proper frequency. | 5.000000 MHz ±5 Hz. |
| 3. | Same as step 1. | Set switch S1F1 at INT OUT. Reconnect P1602 to J1602. Connect coax T connector and test equipment to rear panel FREQ STD IN/OUT connector J2. | Same as step 1. |

## 10.4 FAULT ANALYSIS

Fault analysis procedures for Frequency Standard Modules 724-1600/1601 are presented below in tabular form. Refer to figure 10.3 for the circuit diagram, dc voltage chart, and printed circuit component locations.

**NOTE**

*Extend the module from the unit for access to the printed circuit board and voltage test points.*

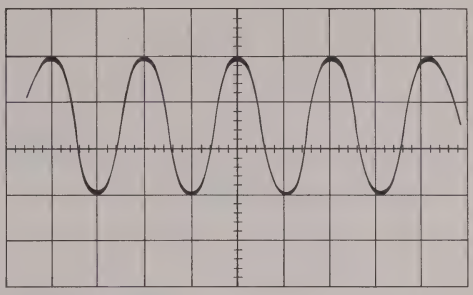



Figure 10.2 – Terminal E4 Waveform

Table 10.1 – Fault Analysis

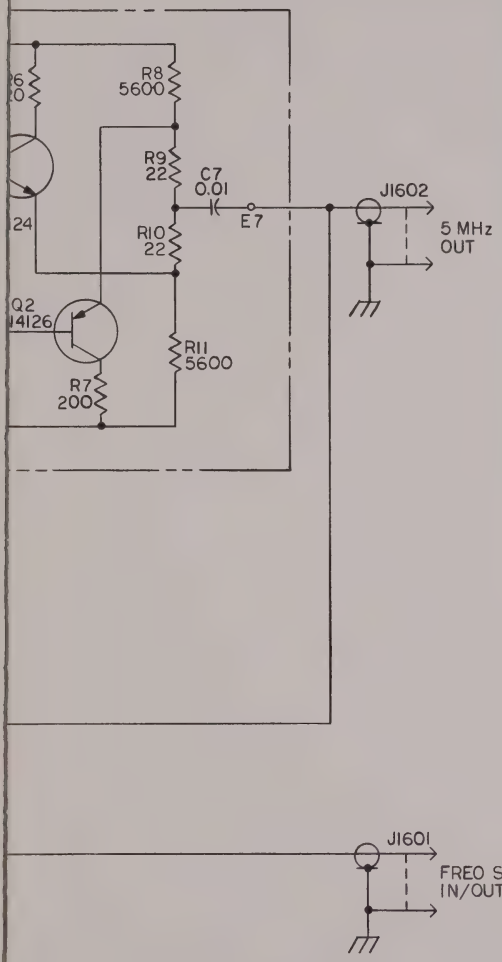
| SYMPTOM | POSSIBLE TROUBLE | CHECKS AND CORRECTIVE MEASURES |
|---|---|---|
| 5 MHz output signal at J1602 absent or improper. | a. Mode switch S1F1 set at EXT IN. | a. Set switch S1F1 at INT ONLY. |
| | b. Defective switch S1F1. | b. Refer to figure 10.3 and make continuity checks. Replace or repair defective switch. |
| | c. Frequency standard defective. | c. Refer to figures 10.2 and 10.3, make waveform and voltage measurements. Replace defective standard and perform the procedures of paragraph 10.3. |
| | d. Distribution amplifier defective. | d. Refer to figures 10.2 and 10.3. Make voltage and waveform measurements. Replace defective component and perform the procedures of paragraph 10.3. |

## 10.5 CIRCUIT DIAGRAM AND PARTS LIST

**NOTE**

*The parts list of the assemblies are located on the back of the circuit diagram.*

# NOTES







NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS.
2. ALL DIODES ARE IN4454.
3. TCXO 724-0150 SUPPLIED WITH 724-1600 ASSY, HIGH STABILITY OVEN A 724-0151 IS OPTIONAL, 724-1601 ASSY.
4. LAST DESIGNATORS:
   R11
   C7
   Q2
   CR6
   L1

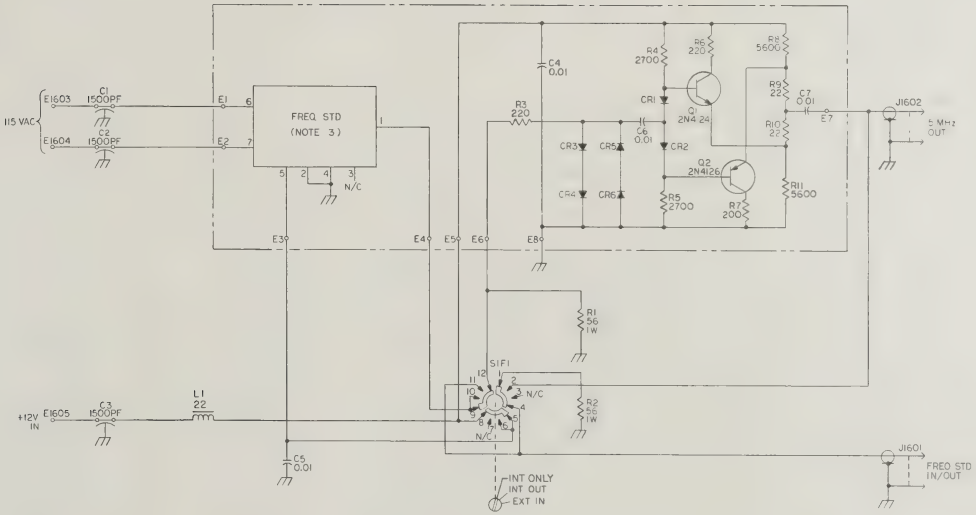
Figure 10.3 – Frequency Standard Module Circuit Diagram

724-1620 Assembly
Component Locations

DC VOLTAGE TABLE*

| Stage | Emitter | Base | Collector |
|---|---|---|---|
| Q1 | 7.0 | 6.5 | 12.0 |
| | 6.0 | 6.5 | 0 |

*All dc voltages taken with multimeter (Simpson 260), referenced to ground at E8.




NOTES.

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS.
2. ALL DIODES ARE IN4454
3. TCXO 724-0150 SUPPLIED WITH 724-1600 ASSY. HIGH STABILITY OVEN A 724-0151 IS OPTIONAL, 724-1601 ASSY.
4. LAST DESIGNATORS.
   R1
   C1
   Q2
   CR6
   L1

Figure 10.3 – Frequency Standard Module Circuit Diagram

## FREQUENCY STANDARD MODULE – 724-1600/1601

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Feed-thru, 1500 UF ±20%; 500 Vdcw | C-2651 |
| C2 | Capacitor, Feed-thru, 1500 UF ±20%; 500 Vdcw | C-2651 |
| C3 | Capacitor, Feed-thru, 1500 UF ±20%; 500 Vdcw | C-2651 |
| C4 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| C5 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| C6 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| C7 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| J1601 | Connector, Coaxial | J-0030 |
| J1602 | Connector, Coaxial | J-0030 |
| L1 | Choke, Rf, 22 UH | L-0632 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 56 ohms ±5%; 1W | R-1619 |
| R2 | Resistor, Carbon; 56 ohms ±5%; 1W | R-1619 |
| R3 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R4 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R5 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R6 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R7 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R8 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R9 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R10 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R11 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| S1F1 | Switch | 724-0019 |
| – | Tube, Socket; PC Mounting | X-1003 |

## FREQUENCY STANDARD MODULE – 724-1600/1601

| Reference Designation | Description | RF P/N |
|---|---|---|
| C1 | Capacitor, Feed-thru, 1500 UF ±20%; 500 Vdcw | C-2651 |
| C2 | Capacitor, Feed-thru, 1500 UF ±20%; 500 Vdcw | C-2651 |
| C3 | Capacitor, Feed-thru, 1500 UF ±20%; 500 Vdcw | C-2651 |
| C4 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| C5 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| C6 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| C7 | Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw | C-0065 |
| CR1 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR2 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR3 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR4 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR5 | Diode, Silicon, Type 1N4454 | CR-0705 |
| CR6 | Diode, Silicon, Type 1N4454 | CR-0705 |
| J1601 | Connector, Coaxial | J-0030 |
| J1602 | Connector, Coaxial | J-0030 |
| L1 | Choke, Rf, 22 UH | L-0632 |
| Q1 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| Q2 | Transistor, Silicon, General Purpose, NPN, Type 2N4124 | Q-0385 |
| R1 | Resistor, Carbon; 56 ohms ±5%; 1W | R-1619 |
| R2 | Resistor, Carbon; 56 ohms ±5%; 1W | R-1619 |
| R3 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R4 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R5 | Resistor, Carbon; 2700 ohms ±10%; 1/4W | R-0029 |
| R6 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R7 | Resistor, Carbon; 220 ohms ±10%; 1/4W | R-0016 |
| R8 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| R9 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R10 | Resistor, Carbon; 22 ohms ±10%; 1/4W | R-0004 |
| R11 | Resistor, Carbon; 5600 ohms ±10%; 1/4W | R-0033 |
| S1F1 | Switch | 724-0019 |
| — | Tube, Socket; PC Mounting | X-1003 |

# APPENDIX

## GENERAL SERVICING NOTES AND PROCEDURES

Special handling of printed circuit boards, semiconductors, and integrated circuits (IC) is necessary to avoid damage.

Use only a low heat soldering iron when removing or installing soldered in parts. When removing a part from a printed circuit board, first unbend the crimped leads; then use only the amount of heat necessary to melt the solder and remove the part immediately while the solder is molten. Clear excess solder from mounting holes, making sure that the holes are open on the printed side of the board before inserting the new component. When removing a transformer, IC, or other part having a multiple number of leads, straighten all leads first and then heat leads one at a time, working around the part until the part can be gently rocked out of its holes.

### NOTE

*Faulty flat pack IC can be removed by clipping the package from the leads and then removing one lead at a time from the pc board with a soldering iron.*

A desoldering iron or a regular soldering iron used in conjunction with a solder remover or a piece of cable braid will greatly simplify removal of solder from multiple lead components. A wood toothpick can be used to clear holes once the part is removed.

When installing or removing a soldered-in semiconductor, grasp the lead, to which heat is being applied, between the solder joint and the semiconductor with long-nose pliers. This will dissipate some of the heat that would otherwise conduct into the semiconductor device from the soldering iron. Make certain that all wires soldered to semiconductor terminals have first been properly tinned so that the connection can be made quickly. Excessive heat may permanently damage semiconductors.

If the copper foil wiring is damaged, a piece of small buss wire can be used to bridge the gap. It is seldom necessary to replace a pc board because of such damage.

Capacitors, resistors, and other two lead components can be replaced without removing the old leads, using the following procedure. This method is not as good as removing old leads and soldering the new part into the board, but it may be used to advantage when time or access to the wiring side of the board is a factor.

a. Cut the component in half with diagonal cutters.

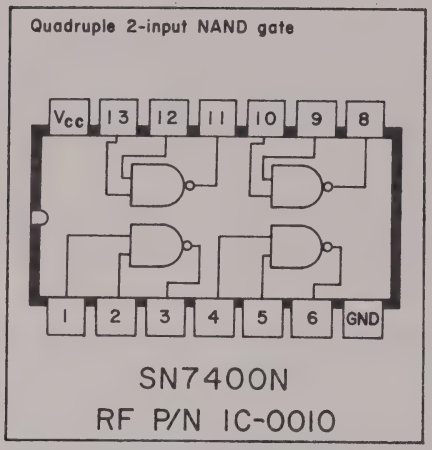
b. Crush the remains of the component, and break the pieces away from the leads. This will leave the maximum lead length remaining.

c. Bend the leads close to the board to form a terminal loop.

d. Connect the leads of the new component to the terminals formed by the old leads, and solder the connections. Be careful to dress the leads so they don't contact other nearby leads.

## IC CIRCUIT DIAGRAMS

The following figures illustrate the pin locations and circuit diagram of the IC that are used in the RF-505 Receiver. Corresponding pin numbers are shown on the various assembly circuit diagrams in this manual.



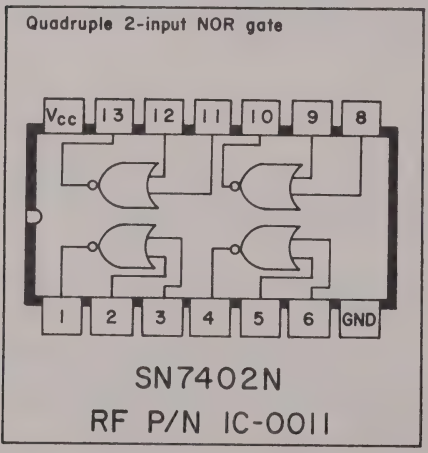
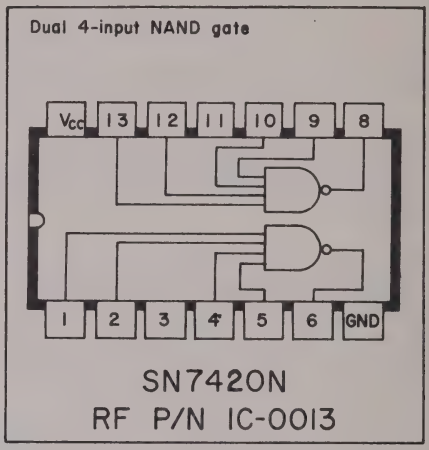




Figure 1 — Circuit Diagrams for IC-0010 and IC-0011



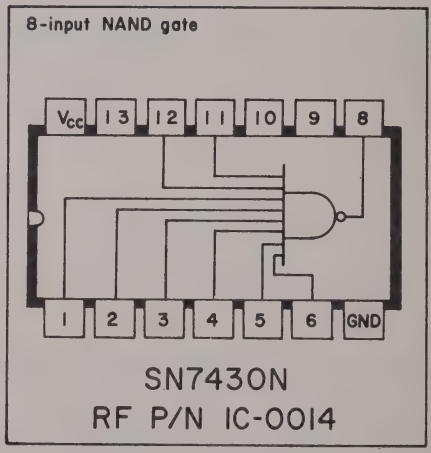
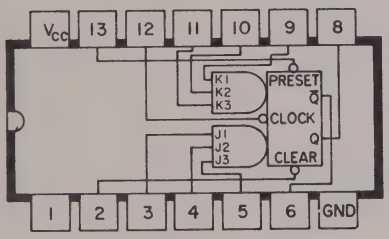



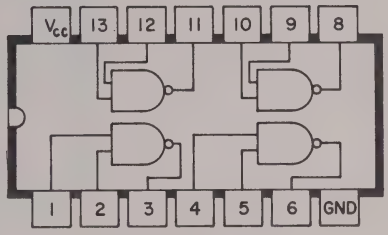

Figure 2 — Circuit Diagrams for IC-0013 and IC-0014

J-K master slave Flip-flop



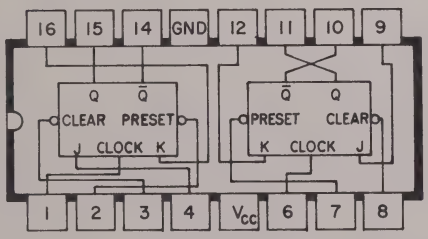

SN7472N
RF P/N IC-0016

Quadruple 2-input NAND gate



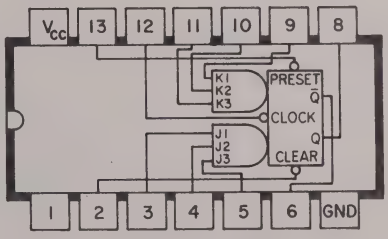

SN74H00N
RF P/N IC-0018

Dual J-K master-slave flip-flop
with preset and clear




SN7476N
RF P/N IC-0017

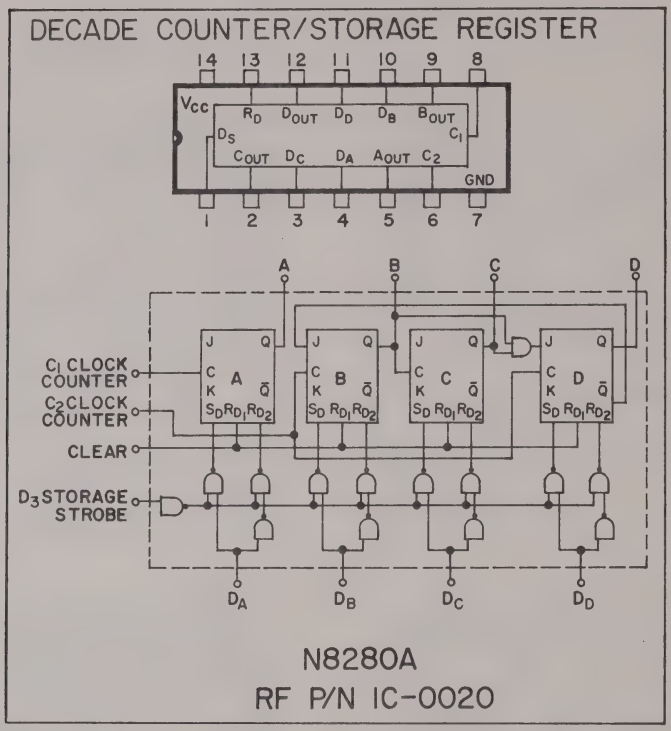
J-K master-slave Flip-flop




SN74H72N
RF P/N IC-0019

Figure 3 — Circuit Diagrams for
IC-0016 and IC-0017

Figure 4 — Circuit Diagrams for
IC-0018 and IC-0019



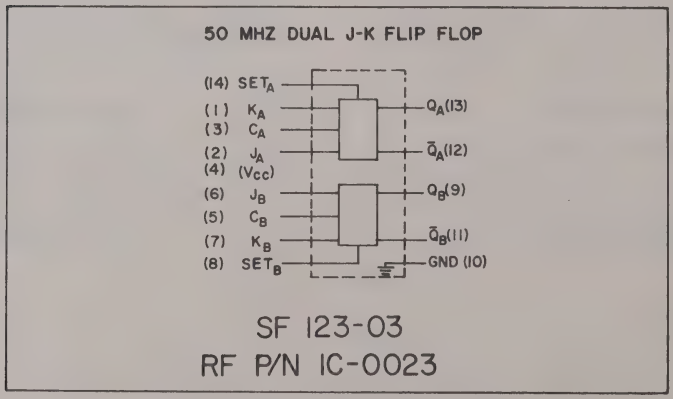
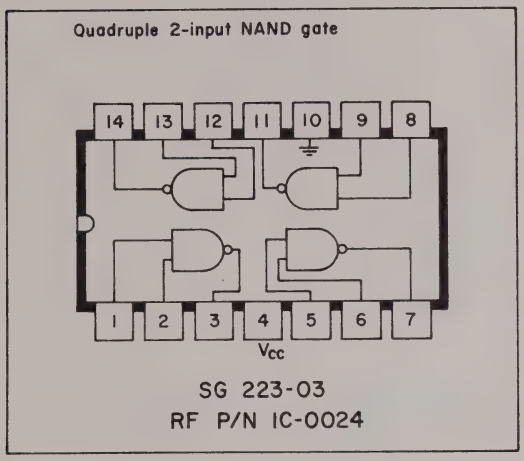




Figure 5 – Circuit Diagrams for IC-0020 and IC-0023



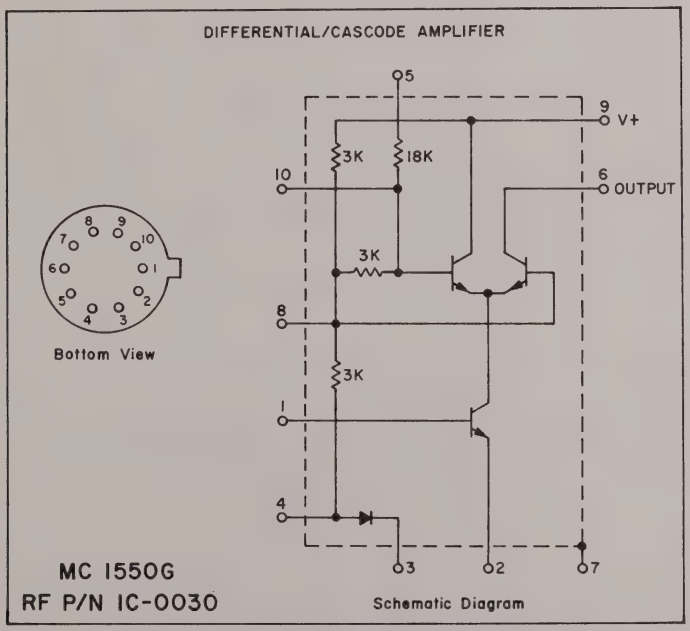
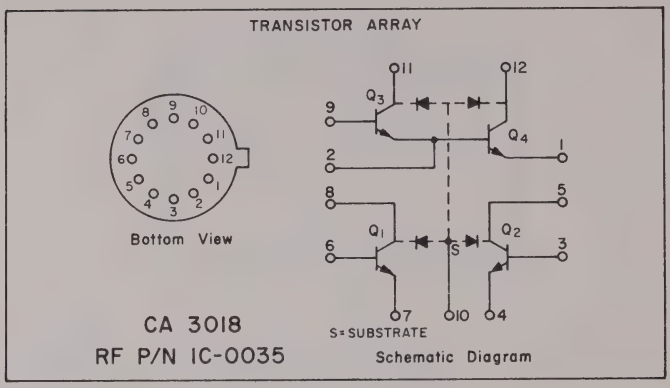




Figure 6 — Circuit Diagrams for IC-0024 and IC-0030



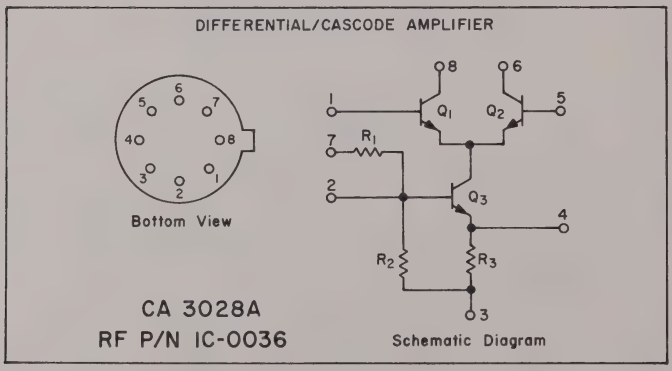
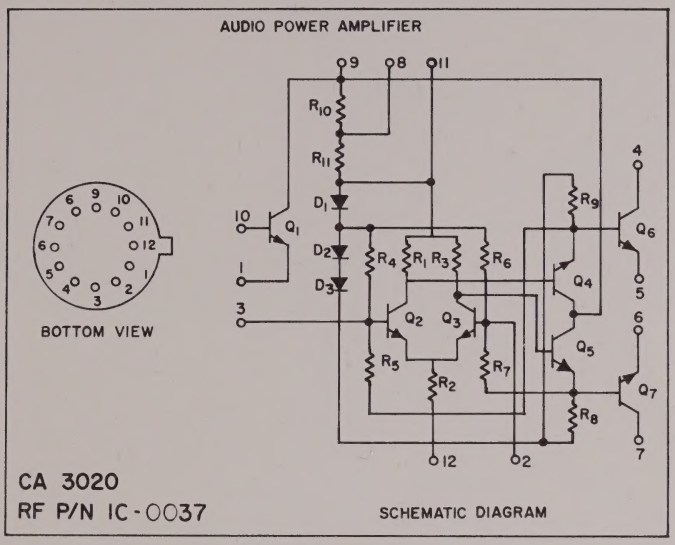




Figure 7 — Circuit Diagrams for IC-0035 and IC-0036



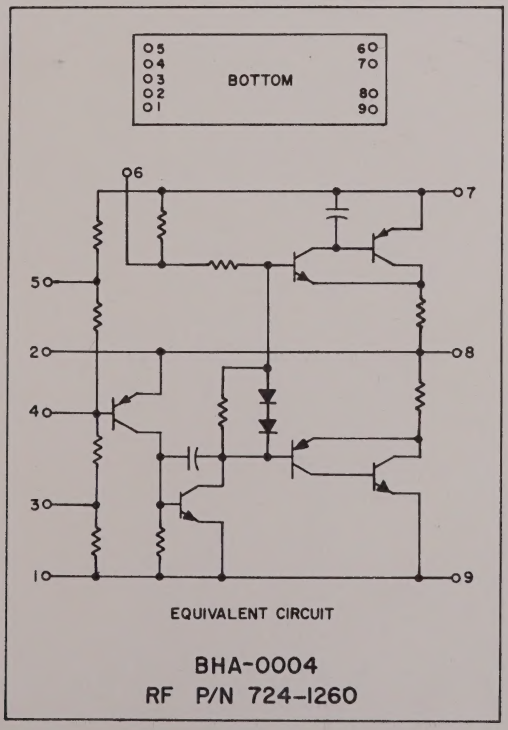
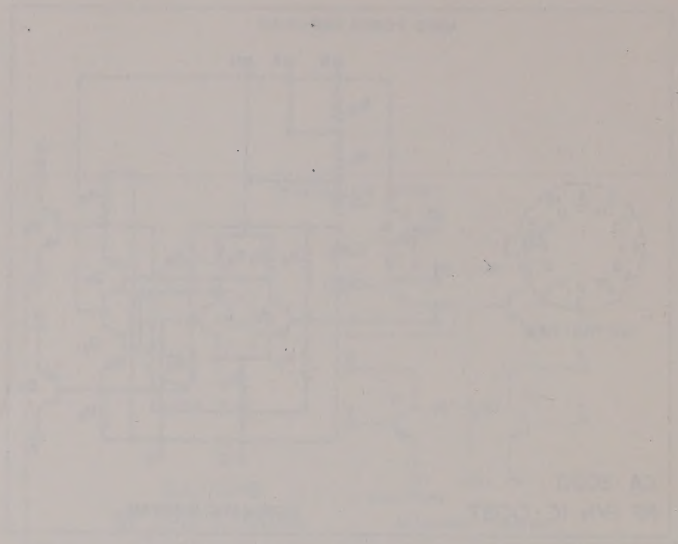
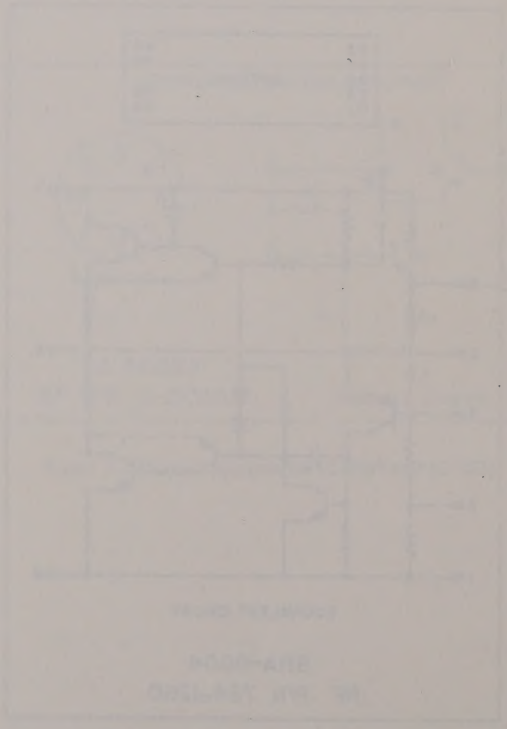




Figure 8 — Circuit Diagrams for IC-0037 and 724-1260





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